

YUCCA MOUNTAIN REPOSITORY PROJECT

HEARING BEFORE THE COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE ONE HUNDRED NINTH CONGRESS

SECOND SESSION

TO

RECEIVE TESTIMONY REGARDING THE STATUS OF THE YUCCA MOUNTAIN REPOSITORY PROJECT WITHIN THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT AT THE DEPARTMENT OF ENERGY

MAY 16, 2006



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YUCCA MOUNTAIN REPOSITORY PROJECT

TUESDAY, MAY 16, 2006

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 10 a.m., in room SD-366, Dirksen Senate Office Building, Hon. Pete V. Domenici, chairman, presiding.

OPENING STATEMENT OF HON. PETE V. DOMENICI, U.S. SENATOR FROM NEW MEXICO

The CHAIRMAN. Good morning. The purpose of this hearing is to evaluate the progress, or lack of progress, of the Department of Energy's Yucca Mountain program and to get a sense of where the project is today.

I would dare say that it is no secret to anyone that I am a zealous proponent of expanding our Nation's nuclear power generation.

Currently, we're at 20 percent of our electricity from nuclear power. But in this age of concern over our Nation's energy security and worry about the destructive results of climate change, we ought to promote more and more development of this limitless domestic resource of energy that produces no air emissions and no problems with reference to climate change and many other problems.

But as we do that, we also agree to get on with a plan for the spent fuel. Each year, American commercial reactors continue to produce 2,000 more metric tons of spent fuel. And right now, more than 55,000 metric tons of spent nuclear fuel and high-level radioactive waste is now stored at more than 121 sites in 39 States. These reactors sit rather quietly and produce clean emissions of free electricity. Americans get the benefit of clean air and can always depend on lights coming on in their homes.

Beyond the need to maintain a high standard of living for Americans and a robust economy that is largely energy driven, we must consider the national security element that is also related to the spent fuel project. It is important to keep in mind that 40 percent of our Nation's warships are powered by nuclear fuel, which eventually becomes spent fuel and needs to be disposed of in Yucca Mountain supposedly. At least that was the plan.

Additionally, final disposition is also needed for the spent fuel from the foreign research reactor programs. Under these research programs, the United States provides nuclear fuel for foreign research reactors and the programs attendant therewith, with the requirement that participating countries must return the fuel to the

United States; that is, return it to the United States for disposition. Repatriating this spent fuel to the United States is essential to prevent proliferation of nuclear materials around the world.

The Yucca Mountain project has a very long and extensive pedigree, starting back in the late 1950's when the National Academy of Sciences, which reported to the Atomic Energy Commission, suggested that burying radioactive high-level waste in geologic formations should receive consideration.

The Nuclear Waste Policy Act of 1982 established a system for selecting the geologic repository for the permanent disposal of up to 70,000 metric tons of spent nuclear fuel and high-level waste. The Department of Energy, shortly thereafter, entered into contracts with utilities that owned nuclear reactors with the expectation to begin high—to begin taking spent fuel by 1998.

However, it wasn't until 2002 that the Congress passed and President Bush signed H.J. Res. 87, approving the site at Yucca Mountain, NV, for the development of a geologic repository for the disposal of the fuel. The viewpoint in 2002 of many in the Congress was that this issue was considered "closed."

But we have found that isn't the case at all. I believe many of my colleagues today would ask, "Why are we here? Wasn't this issue solved in 2002? What needs to be done to get this program back on track?"

Well, I would like the answers to these questions today and to explore with the witnesses how to make this program work if we can.

Testifying before the committee today are: Mr. Paul Golan, acting director of the Office of Civilian Radioactive Waste at the Department of Energy. We thank you very much for being here and for your continued persistence and knowledge in this area.

Mr. William Wehrum, Jr., acting assistant administrator of the Office of Air and Radiation at the Environmental Protection Agency. We thank you very much for your being here and for all of the highly technical work that you and your people do regarding this issue.

Dr. John Garrick, chairman, U.S. Nuclear Waste Technical Review Board. Doctor, thank you very much for being here.

And then we have Mr. Bob Loux, executive director, Agency of Nuclear Projects, Nuclear Waste Project Office within the Office of the Governor of Nevada. We welcome you. You have been in your position for quite some time. How many years now?

Mr. LOUX. Over 25.

The CHAIRMAN. You are growing old with the project, right? I don't know what else to say. I have other things going through my mind that I won't say. Having said that, we will proceed. We're going to start now with the witnesses and proceed right on through.

OK, Dr. John Garrick, chairman of the U.S. Nuclear Waste Technical Review Board, from Arlington, VA. Your statement is available and we will make it part of the record in its entirety as if read. Now, we would like to hear from you, sir.

[The prepared statement of Senator Thomas follows:]

PREPARED STATEMENT OF HON. CRAIG THOMAS, U.S. SENATOR FROM WYOMING

Good morning.

I want to thank all of the witnesses for their participation in this important hearing. I will be brief, but I think there are some important points to be made here today.

First of all, I want to emphasize the importance of nuclear power. This fuel accounts for roughly 20 percent of our nation's electricity. This Committee met yesterday to discuss reliability. A big part of that effort is having enough power to meet demand. At 20 percent, nuclear power is certainly doing its share.

Nuclear Energy is also clean. Unlike coal, which provides more than half of our electricity, we do not have to worry about carbon dioxide, nitrogen oxide, sulfur dioxide, particulate matter, and all of the other emissions that we worry about.

It is also safe. Of all the industries in the United States, Nuclear has one of the most impressive safety records out there.

As a result of all these things, we included significant support for increased nuclear generation in the Energy bill. The Federal Government has an obligation to deal with the leftover fuel from those operations.

Yucca Mountain is an essential part of that obligation.

Massive amounts of time, money, and effort have gone into making sure that we have gotten this project right. We need to do this the right way, and I believe we have, but patience is wearing thin on some of the delays we've seen. I would really like to know what the realistic timeline is for this project.

I look forward to hearing from our witnesses the progress that has been made in this project, and what needs to be done to begin shipping spent fuel to that repository.

I thank you, Mr. Chairman, for convening this important hearing.

STATEMENT OF B. JOHN GARRICK, CHAIRMAN, U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD

Mr. GARRICK. Mr. Chairman and members of the committee, good morning.

The 11 members of the board are appointed by the President and serve on a part-time basis. Most of us have full-time occupations. In my case, I am a consultant in the nuclear science and engineering fields, specializing in the application of the risk sciences to complex technological systems. I am very pleased to be here today and to represent the board at this hearing on the status of the Yucca Mountain project.

As you know, Mr. Chairman, the board was created by Congress in the 1987 amendments to the Nuclear Waste Policy Act and charged with independently evaluating the technical and scientific validity of the Department of Energy, DOE, activities related to disposing of, packaging, and transporting high-level radioactive waste and spent fuel.

The board's technical evaluation focuses on pre-closure and post-closure issues, including the operational, safety and security performance of the proposed repository and the overall performance of the integrated waste management system. The board believes that an important part of its mandate is providing technical information to policymakers.

For that reason, I am especially pleased to participate in the hearing. I will summarize the major points from my testimony and ask that my full testimony be added into the hearing record.

Mr. Chairman, the board believes that the Department of Energy has made meaningful progress over the last year, especially in obtaining information on the capability of the engineered barrier system and on groundwater flow in the repository. DOE has also in-

creased its ability to evaluate pre-closure and post-closure performance as an integrated system.

In addition, the acting director, Paul Golan, has reorganized the program and a canister-based system that can be used for storage, transportation and disposal of spent fuel has been proposed. As a result, the board is reasonably confident that the project can develop the additional evidence for the board to credibly evaluate how the entire waste management system will perform.

The additional evidence referred to involves a few specific areas. For example, given the claims of conservatism by DOE in source term and radionuclide transport models, the board believes that carrying out realistic performance assessments, perhaps in parallel with DOE's efforts to develop a compliance case, could establish a baseline for measuring how conservative DOE's repository performance estimates are. The idea is to get from the experts their best shot at just how well they believe the repository can perform.

We also have encouraged DOE to focus on improving the understanding of the chemical form of the radionuclide source term and the tracking of the radionuclides most significant to dose through the engineered and natural systems. The Department of Energy Science and Technology Program is conducting investigations on the source term and the board believes this important work should continue.

Another important issue that needs to be resolved is the potential for corrosion of the waste packages. DOE maintains that the localized corrosion of alloy 22 at elevated temperatures can be excluded from its performance assessment calculations. The board believes that the technical basis for the conclusion is not compelling and that it is important to obtain better experimental information on localized corrosion and the likely waste package environment after repository closure. The board will hold a workshop in September to discuss these issues.

The board continues to question DOE's understanding of the potential for retarding and retaining radionuclides in the unsaturated and saturated zones under the proposed repository and believes that additional work on radionuclide transport is warranted, especially for the condition of a more realistic source term that considers possible secondary phases of the dose contributing radionuclides. If source term investigations show that neptunium and plutonium exiting the engineered barrier system are captured in secondary mineral phases, the possibility exists that estimates of the natural system's capability to isolate dose-contributing radionuclides could be increased.

The Department of Energy's new proposal involving a canister system for transporting, aging and disposing of spent-fuel holds promise. However, the board believes that the project should fully evaluate the range of consequences associated with its implementation.

An issue that affects pre-closure operations, as well as post-closure for repository performance, is thermal management. For example, the new canister system will have implications for DOE's thermal management strategy and DOE's above-boiling repository design will affect the potential for corrosion of the waste packages.

The board believes that DOE needs to consider the system-wide implications of heat on the waste management system and strengthen the technical basis for its thermal management strategy.

Mr. Chairman, the board believes that the work that I have just discussed is doable and necessary for enhancing confidence in estimates of the repository and waste management system performance.

On behalf of the board, I thank the committee for inviting us to participate in this hearing. We hope that the information that we have furnished today will be helpful in providing context for important decisions you will make on disposing of and managing spent nuclear fuel and high-level radioactive waste.

I will be pleased to respond to any questions you may have.

[The prepared statement of Mr. Garrick follows:]

PREPARED STATEMENT OF B. JOHN GARRICK, CHAIRMAN, U.S. NUCLEAR WASTE
TECHNICAL REVIEW BOARD

Mr. Chairman and members of the Committee, good morning. My name is John Garrick. I am Chairman of the U.S. Nuclear Waste Technical Review Board. The 11 members of the Board are appointed by the President and serve on a part-time basis. Most of us have full-time occupations. In my case, I am a consultant specializing in the application of the risk sciences to complex technological systems in the space, defense, chemical, marine, and nuclear fields. I am pleased to represent the Board at this hearing on the status of the Yucca Mountain program.

As you know, Mr. Chairman, the Board was created by Congress in the 1987 amendments to the Nuclear Waste Policy Act and charged with performing an ongoing and independent evaluation of the technical and scientific validity of Department of Energy (DOE) activities related to disposing of, packaging, and transporting high-level radioactive waste and spent nuclear fuel. The Board began its work in 1989 and has continuously reviewed the technical and scientific validity of DOE activities since that time.

The Board's technical evaluation focuses on pre-closure and post-closure issues, including (1) the operational, safety, and security performance of the proposed repository and (2) the overall performance of the integrated waste management system. The Board believes that a central part of its mandate is providing information on its technical evaluation to members of Congress who will make important decisions on the management and disposal of spent nuclear fuel and high-level radioactive waste. For that reason, the Board is especially pleased to participate today in this hearing on the status of the proposed repository at Yucca Mountain in Nevada.

Mr. Chairman, over the last 18 months or so, the Board held a series of meetings with the DOE that enabled the Board to engage in detailed technical discussions of methods of analysis used by the program. The Board will soon release a report to Congress and the Secretary of Energy that summarizes the Board's activities over the last year and that includes details of its evaluation of the DOE's technical and scientific work. In my testimony today, I will highlight some of the key issues discussed in that report and other issues that have emerged in the last few weeks.

Before I discuss in more detail the Board's technical evaluation of DOE activities related to Yucca Mountain, I want to make clear that, in general, the Board believes that the DOE has made meaningful progress over the last year, especially in obtaining information on the performance capability of the engineered barrier system and on the chemistry, magnitude, and rates of mountain-scale groundwater flow in the unsaturated and saturated zones under ambient temperature conditions. Using sophisticated simulation models, the DOE also has improved its ability to evaluate pre-closure and post-closure performance as an integrated system. In addition, efforts have been made to reorganize the program, and a major proposal for implementing a canister-based system that can accommodate storage, transportation, and disposal of spent nuclear fuel has been proposed. As a result, the Board believes that additional evidence necessary for credibly evaluating the performance of the entire waste system can be developed. I will now discuss in more detail the status of some important technical issues.

REALISTIC PERFORMANCE ASSESSMENT

Mr. Chairman, as you would expect, the DOE's efforts to prepare a license application have dominated its work for the last several years. The primary tool used by the DOE to evaluate the performance of the repository is total system performance assessment, or TSPA. TSPA is a comprehensive set of computer models that uses experience, available data, assumptions, and probabilities to estimate potential dose and compliance with the regulatory standard. Uncertainty is necessarily associated with these projections that are made for periods of up to one million years. To deal with uncertainty or gaps in understanding, the DOE often uses what it considers conservative assumptions about the features or processes being modeled. Examples of this are the ways that the DOE models the temperature dependence of generalized corrosion rates, sorption in the saturated zone, and the containment capability of some parts of the engineered barrier system.

However, because the DOE's assumptions are not always conservative, the overall degree of conservatism is hard to assess. Consequently, TSPA may not give a realistic picture of how a proposed repository would perform. The Board believes that carrying out realistic performance analyses, perhaps in parallel with efforts to develop a compliance case, could establish a "baseline" for measuring how conservative—or nonconservative—the DOE's repository performance estimates might be. Having this information would provide decision-makers, the scientific community, and affected parties with important and relevant information.

In addition, the Board believes that there is considerable uncertainty about the source term incorporated in TSPA. (The source term refers to the compositions, kinds, and amounts of radionuclides that make up the source of a potential release of radioactivity from the engineered barrier system to the host rock.) To increase confidence in performance estimates, the Board has suggested that the DOE focus on analyzing the source term and tracking the radionuclides most significant to dose (neptunium-237 and plutonium-242) through the engineered and natural systems. The DOE is trying to increase its understanding of the source term through work sponsored by its Science and Technology Program. The Board believes that this important work should continue.

THE ENGINEERED SYSTEM

The outer barrier of the waste package is made of a corrosion-resistant material known as Alloy 22. Alloy 22 will not corrode significantly unless liquid water is present on the waste package surface. The higher the temperature at which liquid water is present, the greater the concern because metals corrode faster and are more susceptible to corrosion at higher temperatures. The DOE maintains that potential localized corrosion of Alloy 22 at elevated temperatures under aqueous conditions can be excluded from its TSPA calculations. In the Board's view, the technical basis for the exclusion is not compelling. The Board continues to believe that obtaining experimental data on localized corrosion should be a high priority, especially given the DOE's current high-temperature repository design. In addition, future performance assessments should not exclude general corrosion at elevated temperatures when aqueous conditions are predicted to be present. The Board will hold a workshop in September at which issues related to localized corrosion will be discussed.

THE NATURAL SYSTEM

The natural geologic system at Yucca Mountain will play an important role as a barrier to radionuclide transport. Properties of the natural system will affect the speed of transport and the effectiveness of the engineered barriers. Over time, the DOE has continued to refine and update its model for flow and transport in the unsaturated zone. At this point, no evidence has been developed that calls into question the DOE's long-held view that flow in the unsaturated zone is dominated by fractures and faults. In addition, the Project's findings on the chemistry of water in the unsaturated and saturated zones appear broadly consistent with a large body of empirical data and experience. However, the Board continues to question the DOE's understanding of the unsaturated zone beneath the proposed repository in relation to retarding and retaining radionuclides. The Board believes that obtaining additional information on radionuclide transport is warranted, especially on secondary minerals and on colloid-facilitated radionuclide transport. Such information could be important for assessing repository performance. For example, if future investigations confirm that neptunium is captured in secondary mineral phases, estimates of the natural system's capability to isolate dose-contributing radionuclides could increase.

THE WASTE MANAGEMENT SYSTEM

The Board believes that the DOE's new proposal for a canister-based system for transporting, aging, and disposing of (TAD) spent fuel holds promise as a way of minimizing the handling of bare spent-fuel assemblies and simplifying the design of surface facilities at Yucca Mountain. However, the success of such an approach depends on a number of factors, including close cooperation and coordination among the DOE, nuclear utilities, and cask vendors. The DOE also must consider the range of consequences associated with implementing the TAD concept for pre-closure and post-closure performance. The DOE's evaluation of TAD should include a more complete set of scenarios for waste acceptance, waste transportation, repository operations, design of repository surface facilities, and waste emplacement in the repository.

The DOE has developed the Total System Model (TSM), which can be used as a tool for analyzing a variety of pre-closure scenarios and the performance of the entire waste management system. The TSM can be used to examine system throughput and to identify possible choke points; it can assess the effects of delayed construction of a rail spur; and it can evaluate conditions that contribute to efficient operation of the surface facilities. For the TSM to be used most effectively, it should have the ability to represent "upset" conditions and to analyze all waste management components, including emplacement. The TSM also should be based on the most up-to-date information, and the assumptions underlying the model should be confirmed.

Because of funding constraints, much of the Project's anticipated work on establishing a transportation network has been deferred. Nonetheless, the Board believes that the Project should perform a comparative risk analysis of rail corridors that might be used for moving spent fuel and high-level radioactive waste to Yucca Mountain, and, once that analysis has been completed, should inform all interested and affected parties of what routes it prefers. The DOE also should develop a contingency plan for greater use of legal-weight and heavy-haul trucking.

CROSS-CUTTING ISSUES

An issue that permeates pre-closure operations as well as post-closure repository performance is the DOE's strategy for managing the heat generated by radioactive decay. For example, post-closure thermal requirements create constraints on plans for pre-closure operations and the design of surface facilities at Yucca Mountain. Moreover, implementation of TAD will have implications for the thermal management strategy that do not appear to have been fully considered. As mentioned earlier, after the repository is closed, above-boiling repository temperatures that will last for about 1,000 years (the so-called thermal pulse) will affect the performance of the engineered system, including the waste packages. In particular, the potential for localized corrosion to initiate during the thermal pulse has yet to be resolved. In general, the Board believes that the DOE should consider the systemwide implications of and strengthen the technical basis for its thermal-management strategy, which also will be important for licensing.

I have referred several times in my statement to one or another "system." The Board often uses this term to emphasize that all the elements involved in packaging, transporting, and disposing of spent nuclear fuel and high-level radioactive waste are connected, so the assessment of the behavior and performance of one element may strongly depend on or affect the behavior and performance of others. The Board believes that the DOE's pre-closure and post-closure plans for the repository should recognize and accommodate those interdependencies. That is the reason that, over the years, the Board has strongly recommended integration of program elements across the broad range of scientific and engineering activities. The Board believes that any program reorganization should reflect the need to facilitate this essential integration.

Finally, Mr. Chairman, the Board believes that the technical work I have just discussed is doable and will enhance confidence in estimates of the performance of the repository and the waste-management system. The Board thanks the Committee for inviting it to participate in this hearing and hopes that the information we have furnished today will be helpful in providing a technical context for important decisions that you will make on disposing of and managing spent nuclear fuel and high-level radioactive waste.

I will be pleased to respond to questions.

SUPPLEMENTARY INFORMATION ON THE U.S. NUCLEAR WASTE
TECHNICAL REVIEW BOARD

ABOUT THE BOARD

The U.S. Nuclear Waste Technical Review Board was established on December 22, 1987, in the Nuclear Waste Policy Amendments Act (NWPAA) as an independent agency in the executive branch of the federal government. The Board is charged with evaluating the technical and scientific validity of activities undertaken by the Secretary of Energy, including the following:

- site characterization
- activities related to packaging and transporting high-level radioactive waste and spent nuclear fuel.

The Board was given broad latitude to review activities undertaken by the Secretary of Energy in implementing the Nuclear Waste Policy Act. However, the Board was not given authority to require the DOE to implement Board recommendations.¹ The Board is required to report its findings and recommendations at least twice each year to Congress and the Secretary of Energy.

BOARD MEMBERS

The NWPAA authorized a Board of 11 members. All the members serve on a part-time basis; are eminent in a field of science or engineering, including environmental sciences; and are selected solely on the basis of distinguished professional service. The law stipulates that the Board shall represent a broad range of scientific and engineering disciplines relevant to nuclear waste management. Board members are appointed by the President from a list of candidates recommended by the National Academy of Sciences. To prevent gaps in the Board's comprehensive technical review, Board members whose terms have expired continue serving until they are reappointed or their replacements assume office. The first members were appointed to the Board on January 18, 1989. Current members were appointed by President George W. Bush.

The names and affiliations of the current 11 Board members are listed below.

- B. John Garrick, Ph.D., P.E., is Chairman of the Board. A founder of PLG, Inc., he retired from the firm in 1997 and is an executive consultant. His areas of expertise include applications of the risk sciences to complex technological systems in the space, defense, chemical, marine, and nuclear fields.
- Mark D. Abkowitz, Ph.D., is professor of civil and environmental engineering and director of the Vanderbilt Center for Environmental Management studies at Vanderbilt University. His areas of expertise include transportation safety and security, systems analysis, all-hazards risk management, and applications of advanced information technologies.
- William Howard Arnold, Ph.D., P.E., a private consultant, retired from Louisiana Energy Services in 1996. He holds a doctorate in experimental physics and has special expertise in nuclear project management, organization, and operations.
- Thure E. Cerling, Ph.D., is Distinguished Professor of Geology and Geophysics and professor of biology at the University of Utah. His areas of expertise include terrestrial geochemistry and geochemistry processes.
- David J. Duquette, Ph.D., is department head and professor of materials engineering at Rensselaer Polytechnic Institute. His areas of expertise include the physical, chemical, and mechanical properties of metals and alloys.
- George M. Homberger, Ph.D., is Ernest H. Emeritus Professor of Environmental Sciences in the Department of Environmental Sciences at the University of Virginia. His areas of expertise include catchment hydrology and hydrochemistry and transport of colloids in geologic media.
- Andrew C. Kadak, Ph.D., is Professor of the Practice in the Nuclear Science and Engineering Department at the Massachusetts Institute of Technology. His areas of expertise include nuclear engineering and the development of advanced reactors.
- Ronald M. Latanision, Ph.D., is emeritus professor of materials science and engineering at the Massachusetts Institute of Technology and a principal in Exponent, a science and engineering firm. His areas of expertise include materials processing and corrosion of metals and other materials in aqueous environments.

¹Taken from Legislative History of the Nuclear Waste Policy Amendments Act of 1987; February 26, 1998.

- Ali Mosleh, Ph.D., is Nicole J. Kim Professor of Engineering, director of the Reliability Engineering Program, and director of the Center for Risk and Reliability at the University of Maryland. His areas of expertise include methods for probabilistic risk analysis and reliability of complex systems.
- William M. Murphy is associate professor in the Department of Geological and Environmental Sciences at California State University, Chico. His research focuses on geochemistry, including the interactions of nuclear wastes and geologic media.
- Henry Petroski, Ph.D., P.E., is Aleksandar S. Vesic Professor of Civil Engineering and professor of history at Duke University. His areas of expertise include the interrelationship between success and failure in engineering design. He also has a strong interest in invention and in the history of evolution of technology.

The CHAIRMAN. Thank you very much, sir. Your written testimony has been submitted.

Paul Golan, acting director of the Office of Civilian and Radioactive Waste, U.S. Department of Energy, we thank you for being here, sir.

**STATEMENT OF PAUL M. GOLAN, ACTING DIRECTOR FOR THE
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT,
DEPARTMENT OF ENERGY**

Mr. GOLAN. Thank you, Mr. Chairman. I appreciate the opportunity to come before this committee to provide a status update of the Yucca Mountain Project.

A year ago, Secretary Bodman gave me rather explicit direction to make Yucca Mountain safer, make it simpler and make it more reliable. Today, I would like to provide a project status update on actions we have taken.

In October 2005, the Department announced a redirection to a primarily clean-canistered approach to spent-fuel handling. A single canister, also called the "TAD", would be used to transport, age and dispose of waste without the need to reopen the waste package and handle spent nuclear fuel. We are working with industry to develop the specifications for this canister, and envision that the spent fuel will be primarily packaged by the utilities.

The Department would take advantage of existing commercial fuel-handling and packaging capability while eliminating the need to construct and operate two massive dry fuel handling facilities that had been planned.

We are reviewing the design for this approach and, with approval by the Secretary, will incorporate it into our baseline. Later this summer, the Department intends to put forward its licensing schedule and we will then come back and brief the committee and its staff.

In March 2005, the Department became aware of project e-mails between some employees of the U.S. Geological Survey that indicated non-compliance with QA requirements associated with infiltration modeling work. Infiltration is an important parameter as it helps predict water flow through Yucca Mountain over time.

In February 2006, the Department issued its technical report, which I have a copy of here, which found out that the USGS infiltration rate estimates were consistent with the conclusions of work completed by scientists independent of this project. Our review also confirmed that the USGS infiltration rate estimates were consistent with arid and semi-arid region hydrology from around the

United States, including estimates from the Nevada's Engineering Office.

Because our QA requirements were not met, we decided to replace the affected work and directed Sandia National Laboratories to redevelop pertinent computer codes. We will replace the USGS estimates after Sandia's work has been completed and independently—after it has been completed and independently reviewed, and expect to complete that work by the end of this year.

We are working to improve our quality and culture and fix problems while they are small and, as a result, have directed several work suspensions and work stoppages over the last several months. We will take whatever action is necessary to ensure our work products meet our QA requirements. Our goal is to have all of our work done right the first time, every time.

We're working to establish a "trust but verify" culture and ensure that we have the ability to independently review key areas of our technical work. We have tasked a university-based consortium, the Oak Ridge Institute for Science and Education, ORISE, to perform this function.

Also, in bringing the best and brightest to this project, in January we designated Sandia as our lead lab to coordinate and organize our scientific work. In choosing Sandia, we take full advantage of the great resource of our national laboratories and Sandia stands out as one of our Nation's finest labs. Sandia, as you will recall, performed similar work for the very successful waste isolation pilot plant. We expect to take full advantage of the lessons they have learned. Transition is underway and we're expecting it completed by year-end.

In August 2005, the EPA revised—issued revised Draft Radiation Protection Standards for Yucca Mountain in response to a U.S. Court of Appeals decision to extend peak dose to one-million years following waste disposal operations. The proposed rule contains the existing 10,000-year protection standard of 15 millirems and supplements it with an additional 350 millirem per year standard at the time of peak dose.

The Department supports this approach. Clearly, there are health effects associated with radiation exposure and we should work to ensure that any exposure is as low as reasonably achievable. We believe the proposed standards are protective and the health effects of such exposures are quite low when compared to other risks that society normally and routinely accepts today.

For example, the allowable dose for an individual at the location of peak dose at Yucca Mountain, several hundred thousand years into the future, will be similar to the dose a resident of Denver, or similarly high-altitude areas, receive today.

Further studies have not detected differences in cancer rates in populations for people living in areas with higher levels of background radiation compared to populations that live in areas of lower background levels of radiation.

Last, in accordance with section 161 of the Nuclear Waste Policy Act, the Department has formed a task team to evaluate the need for a second repository, and will prepare the required report to the President and Congress.

Yucca Mountain is important for our Nation. Yucca Mountain will receive the waste from commercial nuclear power plants, which today provide 20 percent of our Nation's electricity, and over time has precluded the mining and consumption of over five billion tons of coal.

The Defense waste at Savannah helped our Nation develop a strategic deterrent to fight and win the cold war. The spent nuclear fuel from the Navy has powered frontline nuclear-powered submarines and aircraft carriers defending our freedom for more than 50 years.

Yucca Mountain is a good site. I believe that our license application will provide the necessary assurance that we can operate Yucca Mountain safely and in compliance with the requirements from both the EPA and NRC.

That concludes my opening statement.

[The prepared statement of Mr. Golan follows:]

PREPARED STATEMENT OF PAUL M. GOLAN, ACTING DIRECTOR FOR THE OFFICE OF
CIVILIAN RADIOACTIVE WASTE MANAGEMENT, DEPARTMENT OF ENERGY

Mr. Chairman and members of the Committee, my name is Paul Golan and I am the Acting Director of the Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM). I appreciate the opportunity to provide an update of the Yucca Mountain Project to the Committee.

About a year ago, Secretary Bodman asked us to take a hard look at Yucca Mountain to find ways in his words to "make it safer, make it simpler, and make it more reliable." With that direction, we have taken actions to improve our operations and processes. I would like to discuss those actions today, including:

1. The clean-canistered approach to waste handling
2. Resolution of concerns associated with infiltration modeling done by the U.S. Geological Survey (USGS)
3. Designation of Sandia National Laboratories as the Project's lead laboratory
4. Use of independent scientific review
5. Environmental Protection Agency (EPA) Radiation Protection Standards
6. Need for a second repository
7. Licensing schedule

1. CLEAN-CANISTERED APPROACH TO WASTE HANDLING

In October 2005, the Department announced a redirection for the Project to a primarily clean-canistered approach to spent nuclear fuel handling operations. A single canister would be used to transport, age, and dispose of the spent nuclear fuel without needing to re-open the waste package and handle individual fuel assemblies. While a transportation, aging, and disposal canister, or TAD, is not certified today, we believe that the technical challenges of this approach can be resolved and will result in simpler, safer, and more reliable operations. We are working with industry to develop canister specifications and working diligently on an acquisition strategy. Under this approach, the spent nuclear fuel will be packaged for disposal primarily by the utilities. This would allow the Department to take advantage of existing commercial capability and to reduce the risks of radiation exposure and contamination from spent nuclear fuel handling operations at the repository by reducing the need to handle individual fuel assemblies several times prior to packaging for final disposal.

The clean-canistered approach requires an examination of the existing repository design and operations. Additional time is required to develop and revise portions of the license application in support of this new approach. The Department is currently reviewing the existing design and developing the appropriate documentation to support a Secretarial decision on the clean-canistered approach. A decision is expected later this summer.

2. INFILTRATION WORK PERFORMED BY THE USGS

In March 2005, the Department became aware of Project emails between some employees of the USGS that suggested non-compliance with certain quality assurance (QA) requirements associated with their work in preparing the water infiltration model and maps. Infiltration is a parameter in the Total System Performance Model predicting the flow of water through the mountain over time.

In February 2006, the Department issued a technical report, evaluating the infiltration estimates developed by the USGS. The independent technical evaluation found the infiltration work completed by the USGS to be consistent with the conclusions of infiltration work completed by scientists independent of this Project, including the State of Nevada's Engineering Officer, under present and future predicted climate conditions. Our review also confirmed that the net infiltration rate of precipitation into Yucca Mountain is very small, in the range of one to six percent of annual precipitation (which itself is a very small amount, approximately 7.5 inches per year).

While we found that the science was sound, some of our QA requirements were not met, and consequently we are expending time and resources to replace the affected work. We have directed Sandia National Laboratories to develop computer codes that will generate new infiltration rate estimates—in accordance with our QA requirements—and then replace the infiltration rate estimates. The Sandia infiltration rates will be independently reviewed prior to incorporation into the Total System Performance Model.

3. LEAD NATIONAL LABORATORY

In January 2006, the OCRWM designated Sandia National Laboratories in Albuquerque, New Mexico the lead laboratory to coordinate and organize all scientific work on the Yucca Mountain Project. Since this Program represents a major scientific and technical challenge, we want to ensure the Program takes full advantage of the resources that reside in our national laboratories.

Today we are working to transition the scientific work to Sandia and expect to complete that transition by the end of the year.

4. USE OF INDEPENDENT SCIENTIFIC REVIEW

To further ensure the highest quality and objectivity of the science and technology supporting the Yucca Mountain Project, we are working to instill a culture of "trust but verify." As part of this effort, we will use a University-based consortium to independently review key aspects of the Project to ensure we stay objective and without bias. In April, the Department selected the Oak Ridge Institute for Science and Education to perform this work. Additionally, we are in the process of implementing the *Safety Conscious Work Environment* across the entire Yucca Mountain Project.

5. EPA RADIATION PROTECTION STANDARDS

In August 2005, the EPA proposed revised standards for Yucca Mountain in response to a decision by the U.S. Court of Appeals for the District of Columbia which vacated portions of the existing EPA radiation protection standards. Specifically, in response to the decision, EPA proposed a radiological exposure limit for the time of peak dose to the general public for a one-million year period following the disposal of waste at Yucca Mountain. This new evaluation period is 100 times longer than the previous period of 10,000 years, and it is longer than any other regulatory period involving quantitative limits.

The proposed EPA rule retains the existing 10,000-year individual protection standard of 15 milliRem per year, and supplements it with an additional standard of 350 milliRem per year at the time of peak dose.

The Department supports the EPA approach.

A rule with two compliance periods recognizes the extraordinary challenges in making quantitative predictions of effects a million years from now. It recognizes:

- The limitations of bounding analyses,
- The greater uncertainties at the time of peak risk, as well as
- The lessened precision in calculated results as time and uncertainties increase.

Retaining the existing 15 milliRem per year standard for the initial 10,000-years ensures that the repository design will include prudent steps, including the use of engineered and natural barriers to limit offsite doses.

Through the one-million year performance period, the natural and engineered barriers will continue to keep exposure levels low, below what many people receive today, depending on where they work or where they live. The proposed 350

milliRem annual limit for the out years reflects a level of risk that society normally lives with *today*. The allowable dose for an individual at the location of peak dose at Yucca Mountain, several hundred thousand years in the future, for example, would be no greater than the *average* dose a resident of Denver, Colorado, or other similar high-altitude location receives today.

Further, studies have not detected that people living in areas with higher levels of natural background radiation have a higher rate of cancer or other radiation-linked illnesses than do those living in areas with lower levels of natural background radiation.

6. NEED FOR A SECOND REPOSITORY

The Department will form a task team to evaluate the need for a second repository. The Department will provide its report, as required by the Nuclear Waste Policy Act of 1982 (NWPAct), to the President and Congress between 2007 and 2010. The Department has projected that more than one hundred thousand metric tons of spent nuclear fuel will be generated by the current licensed commercial reactor fleet, there will be a need for capacity in excess of 70,000 metric tons which is the administrative limit currently imposed by the NWPAct on the Yucca Mountain repository.

7. LICENSING SCHEDULE

The Department is committed to developing a realistic schedule that will result in the submission of a robust license application. Later this summer, we will publish our schedule and strategy for submittal of the license application to the NRC which will be consistent with Section 114 (e) of the Act that directs the Secretary to develop a plan "that portrays the optimum way to attain the operation of the repository." After we publish this schedule, we will provide the Committee and its staff briefings.

CONCLUSION

Over the last 50 years, our Nation has benefited greatly from nuclear energy and the power of the atom, but we have been left with a legacy marked by the generation and accumulation of more than 50,000 metric tons of commercially generated spent nuclear fuel, 2,500 metric tons of DOE spent nuclear fuel, and an estimated 20,000 or more canisters of DOE high-level radioactive waste. Additionally, 2,000 metric tons of commercial spent nuclear fuel will be generated this year and in every succeeding year by the current fleet of commercial electrical power generating reactors as they supply 20% of our Nation's electricity.

There is a clear national need for Yucca Mountain, even if we could reduce our national electricity consumption by 20% and were able to shut down every commercial reactor and nuclear project in the country today. We are taking steps to ensure that we develop and construct the safest, simplest repository that we possible can, based on sound science and quality work.

There is a strong international scientific consensus that the best and safest option for dealing with this waste is geologic isolation. This consensus includes the National Academy of Sciences which has generally endorsed the geologic disposal option as far back as 1957.

To conclude, I believe that our license application will provide the necessary assurances that we can operate Yucca Mountain in compliance with the performance requirements of the EPA and the NRC. We will also demonstrate that our approach to operations will be carefully planned, logical, and methodical.

That completes my prepared statement.

STATEMENT OF WILLIAM WEHRUM, ACTING ASSISTANT ADMINISTRATOR FOR AIR AND RADIATION U.S. ENVIRONMENTAL PROTECTION AGENCY

Mr. WEHRUM. Thank you, Mr. Chairman and members of the committee.

Good morning. My name is Bill Wehrum. I am the acting assistant administrator for the Office of Air and Radiation at the USEPA.

I'm pleased to be here today to provide you with an update on the status of EPA's public health and safety standards for the pro-

posed spent nuclear fuel and high-level radioactive waste repository at Yucca Mountain, NV.

I would like to begin by providing the committee with a short history of EPA's responsibilities and why we have proposed revised standards. The Nuclear Waste Policy Act of 1982 described the roles and responsibilities of Federal agencies in the development of disposal facilities for spent nuclear fuel and high-level waste. EPA was identified as the agency responsible for establishing standards to protect the general environment from such facilities.

In the Energy Policy Act of 1992, Congress delineated EPA's roles and responsibilities specific to the Federal Government's establishment of the potential repository at Yucca Mountain. EPA's role is to determine how the Yucca Mountain high-level waste facility must perform to protect public health and the environment.

Congress directed EPA to develop public health and safety standards that would be incorporated into the NRC licensing requirements for the Yucca Mountain facility. DOE would apply for the license to construct and operate the facility, and the facility would open only if NRC determines that DOE can meet EPA's standards.

In establishing EPA's role, Congress also stated that EPA's safety standards are to be based upon and consistent with the expert advice of the National Academy of Sciences.

EPA established its Yucca Mountain standards in June 2001. As required by the Energy Policy Act, these standards addressed releases of radioactive material during storage at the site and after final disposal.

The storage standard set a dose limit of 15 millirem per year for the public outside the Yucca Mountain site. The disposal standards consisted of three components: an individual dose standard, a standard evaluating the impacts of human intrusion into the repository, and a ground-water protection standard.

The individual-protection and human intrusion standard set a limit of 15 millirem per year to the reasonably maximally exposed individual, who would be among the most highly exposed members of the public.

The ground-water protection standard is consistent with EPA's drinking water standards, which the Agency applies in many situations as a pollution prevention measure. The disposal standards were to apply for a period of 10,000 years after the facility closed. Dose assessments were to continue beyond 10,000 years and be placed in DOE's Environmental Impact Statement, but were not subject to a compliance standard.

The 10,000-year period for compliance assessment is consistent with EPA's generally applicable standards developed under the Nuclear Waste Policy Act. It also reflects international guidance regarding the level of confidence that can be placed in numeric projections over very long periods of time.

Shortly after the EPA first established these standards in 2001, the nuclear industry, several environmental and public interest groups, and the State of Nevada challenged the standards in court. In July 2004, the Court of Appeals for the DC Circuit found in favor of the agency in all issues except one: the 10,000-year regulatory timeframe. The court did not rule on whether EPA's stand-

ards were protective, but did find that the timeframe of EPA's standards was not consistent with the NAS recommendations.

The NAS, in a report to EPA, stated that EPA's standards should cover at least the time period when highest releases of radiation are most likely to occur within the limits imposed by the geologic stability of the Yucca Mountain site. It judged this period of geologic stability for purposes of projecting releases from the repository to be on the order of one million years.

EPA's 2001 standards required DOE to evaluate the performance of the site for this period, but did not establish a specific dose limit beyond the first 10,000 years.

EPA proposed a revised rule in August 2005, to address the issues raised by the appeals court. The new proposed rule limits radiation doses from Yucca Mountain for up to one million years after it closes. No other rules in the United States for any risks have ever attempted to regulate for such a long period of time.

Within that regulatory timeframe, we have proposed two dose standards that would apply based on the number of years from the time that the facility is closed.

For the first 10,000 years, we would retain the 2001 final rule's dose limit of 15 millirem per year. This is protection at the level of the most stringent radiation regulations in the United States today.

From ten thousand years to one million years, we propose a dose limit of 350 millirem per year. This represents a total radiation exposure for people near Yucca Mountain that is no higher than natural levels people live with routinely in other parts of the country.

One million years, which represents 25,000 generations, includes the time at which the highest doses of radiation from the facility are expected to occur.

Our proposal requires the DOE to show that Yucca Mountain can safely contain wastes, even considering the effects of earthquakes, volcanic activity, climate change, and container corrosion over one million years.

The public comment period for the proposed rule closed November 21. We are currently reviewing and considering comments as we develop the final rule. We held public hearings in Las Vegas and Amargosa Valley, NV, and in Washington, DC.

We are considering comments from these hearings, as well as all the comments submitted to the Agency's rulemaking docket. A document describing our responses to all comments will be published along with the final rule. We are making every effort to finalize the rule by end of this year.

Thank you again for the opportunity to appear before the committee and present this update on our standards. This concludes my statement. I would be happy to answer any questions you may have.

The CHAIRMAN. Thank you very much for your testimony. And what a job you have.

Now, having said that, we will take Mr. Loux from Nevada, the 25-year veteran.

**STATEMENT OF ROBERT R. LOUX, EXECUTIVE DIRECTOR,
NEVADA AGENCY FOR NUCLEAR PROJECTS**

Mr. LOUX. Thank you, Mr. Chairman. It's a pleasure to be here and thank you for the invitation. As you know, I am here on behalf of Governor Guinn.

The CHAIRMAN. Yes, indeed.

Mr. LOUX. I am Robert Loux and I am the director of the Agency for Nuclear Projects, which is, as you mentioned, part of the Office of the Governor.

The current status of the Yucca Mountain high-level waste repository project can be described in a single word: unknown—not even uncertain, but unknown. You have heard from the Department of Energy that it cannot provide a schedule for submittal of a license application of the NRC for its review, but the Department representative said it will not take place in 2007.

You've also watched the progression of a potential repository opening date go from the statutory 1998 date to more recent estimates of 2010, maybe 2015, or maybe even 2020.

More recently, just last week at the TRB meeting, one of the Department of Energy representatives indicated that the clean canister or TAD approach, final design will not be available for at least 6 years. And since that design is integral to the design of the repository, it is hard to believe that a license application could be submitted before 6 or 7 years from now. Multiple episodes of redirection of the program, both from within the Department of Energy and Congress, defined the last 20 years of the Yucca Mountain project history.

The current status of the Yucca Mountain project is a product of fundamental, persistent unresolved problems with both the site and project execution, overlain by layers of redirection that wrongly assume the problems have been, or will be resolved. It is bogged down in the morass of technical, legal and managerial problems and it is unrealistic to imagine the project can pull itself out. It is unlikely that any legislative easing of the regulatory rules can alter this prospect.

The technical problems stem ultimately from the fundamental unsuitability of the site. The Department of Energy has been struggling with this since the early 1990's when it discovered there is a lot more water at the site and it was moving much faster than expected from when it settled on the site. Instead of coming back to Congress with the bad news, DOE decided to compensate for the bad site with better packaging, which also doesn't solve the problem.

Since then, billions of dollars of so-called scientific investigation have been directed at rationalizing this decision. In our estimation, much of it is not really science at all. It is not surprising, at least in some cases, that the scientists working the project just made stuff up, as revealed by the e-mail affair involving staff of the USGS working on waterflow through Yucca Mountain. Much of this work—much of the other work now has to be redone at considerable cost.

The quality flag went down in the middle 1990's, too, as revealed in the recent report by the Government Accountability Office. DOE has a long history of chronic quality assurance problems. The latest

problems involve Lawrence Livermore Lab. The Department and its contractors were never imbued with the sense of doing things right. They apparently thought that it's, quote, "all political", and that they would get their way in the end no matter what. Rest assured that should the application be submitted to the Nuclear Regulatory Commission, Nevada will challenge and question DOE's fitness as an applicant and as a licensee.

Legal problems are exemplified by the current litigation in which DOE is desperately fighting to prevent the public release of key licensing documents, documents paid for by the taxpayers.

It is a strange position for a Government agency supposedly devoted to openness in making sound decisions in the public interest. The truth is it is devoted to secrecy and special protection of the bureaucratic and contractor-interest involved in the project.

The main trouble with this approach is secrecy leads to poor decisions and mistakes, and fortunately, secrecy and bullying do not work well in the Federal courts. These legal and technical problems exemplify the poor direction DOE top management has given to the project. Beyond that, however, the Department has been beset with unceasing managerial problems at all level. The latest GAO report lays this out clearly. It describes incompetent, changing managerial personnel, key positions unfilled and poor tracking of problems.

Mr. Chairman, in my own 25 years of personal experience and observation, I believe the project is bogged down by technical problems that stem from the fundamental unsuitability of the site, by inadequate scientific evaluation by DOE, and by DOE's poor direction and inability to manage its contractors. At this point, it is unrealistic to imagine the project can pull itself out of this morass.

With that, Mr. Chairman, I'll conclude and be happy to answer any questions.

[The prepared statement of Mr. Loux follows:]

PREPARED STATEMENT OF ROBERT R. LOUX, EXECUTIVE DIRECTOR,
NEVADA AGENCY FOR NUCLEAR PROJECTS

Thank you for the opportunity to appear before you today. I am Robert Loux, Executive Director of the Nevada Agency for Nuclear Projects, which is a branch of the Office of the Governor of the State of Nevada. The Agency was established by the Nevada Legislature in 1985, to carry out the State's oversight duties under the Nuclear Waste Policy Act. I have served as the Agency director since it was established. Our Agency also serves as staff for the Nevada Commission on Nuclear Projects.

The current status of the Yucca Mountain high-level nuclear waste repository project can be described in a single word: unknown—not even uncertain, but unknown. You have heard from the Department of Energy's Office of Civilian Radioactive Waste Management that it cannot provide a schedule for submittal of a Yucca Mountain repository license application to the Nuclear Regulatory Commission (NRC) for its review. But, Department representatives have said that it will not take place in FY 07. You also have watched the progression of potential repository opening dates go from the statutory 1998 date to a more recent estimate of 2010, and now to maybe 2015 to 2020. Multiple episodes of "redirection" of the program, both from within the Department of Energy and from the Congress, define the past twenty years of the Yucca Mountain project history. The current status of the Yucca Mountain project, within the Office of Civilian Radioactive Waste Management, is a product of fundamental, persistent and unresolved problems, with both the site and the project execution, overlain by layers of redirection that wrongly assume the problems have been, or will be resolved.

SITE RECOMMENDATION AND TECHNICAL BASIS FOR LICENSE APPLICATION

At the time of the Secretary of Energy's Site Recommendation for development of a Yucca Mountain repository on February 14, 2002, it was stated that a license application would be submitted to NRC in late 2004. This plan was announced despite the Nuclear Waste Policy Act requirement that a license application be submitted not later than 90 days after the site designation becomes effective by an act of Congress, which occurred in July 2002. In November 2004, it was announced that the license application would not be submitted during the following month, and it was not known when it would be submitted.

This failure to submit the license application in 2004 came as no surprise, since a regulatory prerequisite for license application submittal had not been met. The Nuclear Regulatory Commission Licensing Support Network Rule requires that DOE certify it has made all documentary material in its possession on the proposed Yucca Mountain high-level waste repository publicly available, in a prescribed manner, at least six months prior to submission of a license application. The intent of this is to expedite the discovery phase of the licensing hearing to meet the tight statutory schedule for a licensing decision by the NRC. On August 31, 2004, the NRC Atomic Safety and Licensing Board ruled that the DOE's June 30, 2004 certification was based on incomplete documentation, and the manner in which DOE made the material publicly available on its own internet web site failed to satisfy the regulations. Nevada's July 12, 2004 motion to strike the certification was granted. This all transpired two years after the Yucca Mountain site designation became effective. DOE has not tendered a new certification, and in its monthly status reports to the Atomic Safety and Licensing Board, as late as this month, stated that it does not have a schedule for resumption of the process.

At the time of the Site Recommendation, DOE announced its priorities for FY 03 were to:

- a) "continue vigorous scientific investigation of repository system behavior;
- b) develop a repository license application; and
- c) accelerate the transportation program."

This confirms that, contrary to statements by then Secretary Abraham and President Bush, the repository program managers were not prepared to move forward with the licensing process, since by law, site characterization, i.e. scientific work, is complete at the time of Site Recommendation with respect to the sufficiency of information for a license application. President Bush, in a February 15, 2002 letter to the President of the Senate and the Speaker of the House, said, "This recommendation . . . will permit *commencement* of the next rigorous stage of scientific *review* of the repository program through formal licensing proceedings before the Nuclear Regulatory Commission." (emphasis added).

Even the Nuclear Regulatory Commission understood that at the time of Site Recommendation, the information for a license application was insufficient because, in its statutorily required statement to the President of its view on whether the "at depth site characterization and waste form proposal seem to be sufficient for inclusion" in the license application, its response was a forecast, not a finding. The Commission indicated confidence that the information *would be* sufficient at the time of license application, but still pending with the Commission was the resolution of 293 Key Technical Issues that DOE had agreed with the NRC staff to have resolved prior to submission of a license application.

The Nuclear Waste Policy Act also required that a Final Environmental Impact Statement (FEIS) for a Yucca Mountain repository accompany the Site Recommendation by the Secretary to the President. The FEIS is the primary document that explains and describes the Proposed Action and the analyses of the impacts of that action. It included some (although far from complete) analysis of the plans to transport the waste to Yucca Mountain from sites in 35 states where the waste is currently generated and stored. However, a Record of Decision, the mandatory document which records a federal decision based upon the FEIS process, did not accompany the Site Recommendation, as it must have if DOE was ready to proceed with the licensing and development phase of the repository project. It was not until April 2004 that DOE issued a Record of Decision that adopted the preferred alternative of mostly rail transportation to Yucca Mountain and selected the 319 mile-long Caliente Corridor as the Nevada rail construction route to Yucca Mountain—the most costly and difficult of the five alternatives reviewed in the FEIS. Since then DOE has been in the process of preparing a Draft EIS for the alignment and construction of that rail line, which is now estimated to cost, not the originally estimated just under \$1 billion, but \$2 billion.

In February 2004, the Yucca Mountain project, after at least three drafts of a license application had been developed, began a comprehensive evaluation of the key building blocks of the license application, referred to as Analysis Model Reports (AMRs) that are intended to cover all safety and performance aspects of the post-closure repository. This was followed by a critical review of a few selected AMRs by NRC staff, the results of which forecast to observers a difficult and uncertain license application review if both substantive and procedural (including Quality Assurance) remediation was not undertaken. The Project's Regulatory Integration Team (RIT), consisting of 150 scientists and regulatory experts, was created to address problems of traceability and transparency in the documents to ensure they met NRC requirements and expectations. The RIT identified 3,733 Action Items in its review of 117 AMRs (which were later consolidated into 89 AMRs). The large majority of items in need of revision were in the area of insufficient or unclear justification of scientific conclusions (73%). Technical issues made up 7 percent, and procedural inadequacies were the remaining 20 percent. The result was that 89 documents were in need of either significant updating or total revision. The RIT completed its work in an 8-month period, at a cost of about \$20 million. After completion, other AMRs not in the original scope of review were found to need similar scrutiny. The Total System Performance Assessment, the composite model that projects safety compliance of the repository, was undergoing subsequent revision in 2005 and will continue to be revised, based on new developments in late 2005 that will be discussed below.

QUALITY ASSURANCE

An acceptable Quality Assurance program and requirements, procedures, and the demonstration of its effective implementation are integral and indispensable elements of a license application. The Yucca Mountain project has been plagued by Quality Assurance deficiencies since its inception. Even before the 1987 Nuclear Waste Policy Amendments Act, DOE was aware of Quality Assurance problems and the long-term implications of not correcting them and assuring that an acceptable Quality Assurance program was persistent and enduring. In its June 1987 *OCRWM Mission Plan Amendment (DOE/RW-0128)*, DOE wrote:

"As a result of quality-assurance audits performed by the DOE, "stop-work" orders were issued to contractors working on the Hanford and the Yucca Mountain projects. The DOE found that the technical and management controls for work performed before site characterization were not adequate for site characterization activities. A general upgrading of procedures and controls is being implemented to satisfy NRC requirements for establishing a licensing basis and DOE requirements for a major system acquisition. Personnel associated with the stopped work were immediately assigned to develop the required procedures and controls and were given intensified training in quality assurance. The "stop-work" orders were gradually being lifted on certain activities at both sites as the DOE receives evidence that the quality assurance requirements are satisfied." (Page 5).

Since 1988, the General Accounting Office, now the Government Accountability Office, has identified Quality Assurance problems in the Yucca Mountain project in at least 8 reports, some devoted solely to the issue of Quality Assurance (QA). In 1988, GAO warned that the project should not proceed until it had an adequate QA program in place. GAO found, in 1990, that the project did not comply with NRC QA requirements. In 1992, GAO again pointed out the need for an adequate QA program. Reports in 2003 and 2004 spoke to the persistent QA problems. In testimony just last month, on April 25, 2006, to the House of Representatives Committee on Government Reform, Subcommittee on the Federal Workforce and Agency Organization, the GAO Director for Natural Resources and the Environment concluded, based on GAO's most recent report, the following:

"DOE has a long history of trying to resolve quality assurance problems in its Yucca Mountain project. Now, after more than 20 years of work, DOE once again faces serious quality assurance and other challenges while seeking a new path forward to a fully defensible license application. Even as DOE faces new quality assurance challenges, it cannot be certain that it has resolved past problems. It is clear that DOE has not been well served by management tools that have not effectively identified and tracked progress on significant and recurring problems. As a result, DOE has not had a strong basis to assess progress in addressing management weaknesses or to direct management attention to significant and recurrent prob-

lems as needed. Unless these quality assurance problems are addressed, further delays on the project are likely.”

The GAO Director was testifying in the hearing as part of an ongoing House Subcommittee investigation of possible data and Quality Assurance documentation falsification by a few United States Geological Survey scientists modeling groundwater infiltration for the Yucca Mountain project. Groundwater infiltration is key to the repository safety projection in that it affects first the corrosion and failure rate of the metal waste containers, and then the rate of release of radionuclides to the environment.

The investigation stemmed from the revelation of e-mails exchanged among the scientists between 1998 and 2000, but only first discovered by DOE contractor reviewers in late 2004 and revealed to DOE in March 2005. Inspectors General of both the Department of Energy and the Department of Interior investigated the case extensively, looking at e-mail records from the identified time period and later. The reports of the field investigations were forwarded to the United States Attorney’s Office for the District of Nevada, which, on April 24, 2006, declined to pursue criminal prosecution in the matter.

After closing his investigation, in an unusual move, the DOE Inspector General wrote to the Secretary of Energy of his findings and concerns because, during the course of the investigation, “certain internal control deficiencies were identified which were pertinent to the core allegations we were pursuing.” The concerns were over three specific matters: 1) “The nearly six-year delay in surfacing and appropriately dealing with the controversial e-mails was inconsistent with sound quality assurance protocols” (this was the subject of a November 9, 2005 Inspector General Report, *Quality Assurance Weaknesses in the Review of Yucca Mountain Electronic Mail for Relevancy to the Licensing Process*, DOE/IG-0708); 2) “Compromise of scientific notebook requirements” (which, in this case were waived to resolve the fact that, contrary to requirements, no scientific notebook had been initiated or kept for the infiltration model work); and 3) “Critical control files relating to the *Simulation of Net Infiltration for Modern and Potential Future Climates*” AMR were not maintained in accordance with data management system requirements.” The Inspector General concluded:

“The discovery of the e-mails that prompted the Office of Inspector General Criminal Investigation understandably raised concerns over the Yucca Mountain Project’s quality assurance process. The Department has announced that, in order to address these concerns, it has initiated steps to remediate or replace certain work of the Geological Survey and that the quality of the results of this effort will be reviewed by a body of scientists independent of the Yucca Mountain Project. We concluded that these steps are essential in the Yucca Mountain Project is to overcome historical and current quality assurance concerns.”

That the e-mail situation was not an isolated problem seems to have been accepted even by Energy Secretary Bodman, who said, on April 12, that the culture of the Yucca Mountain organization was “reflected in” the USGS e-mail affair. This would suggest the question of whether the scientific underpinnings of the entire Yucca Mountain project merit confidence. For example, the GAO Director’s testimony also described a February 2006 stop-work order on Yucca Mountain work at the Lawrence Livermore National Laboratory:

“We believe this incident is an example of how the project’s management tools have not been effective in bringing quality assurance problems to top management’s attention. After observing a DOE quality assurance audit at the Lawrence Livermore National Laboratory in August 2005, NRC expressed concern that humidity gauges used in scientific experiments at the project were not properly calibrated—an apparent violation of quality assurance requirements. According to an NRC official, NRC communicated these findings to BSC [Bechtel-SAIC] and DOE project officials on six occasions between August and December 2005, and issued a formal report and letter to DOE on January 9, 2006. However, despite these communications and the potentially serious quality assurance problems involved, the project’s acting director did not become aware of the issue until January 2006, after reading about it in a news article.” (emphasis added).

The deficient calibration of the gauges, and other experiment execution problems with Quality Assurance connections and sound science implications, discovered in the audit relate to work that is key to the safety assessment for the repository, because it leads to the engineered barrier corrosion rate data that are included in the Yucca Mountain Total System Performance Assessment.

THE "PATH FORWARD"

A few of the issues currently confronting the Yucca Mountain project were mentioned in the March 21, 2006 Quarterly Management Meeting between DOE and NRC:

Spent fuel handling, transport, storage, and disposal:

A key element of the Energy Secretary's new "simpler, safer" approach is the major redesign of the waste handling facilities, based on a changed operational concept for receipt and handling of waste at the Yucca Mountain site. The concept for receiving commercial spent nuclear fuel and packaging it for underground emplacement has changed significantly through the past 15 years, and just recently has taken yet another turn.

At first the spent fuel assemblies were to have been packaged at the reactor in conventional transport containers, brought to the repository site where a few assemblies were to have been placed in a stainless steel container that then would be emplaced in vertical boreholes in the floor of the repository drifts.

The idea of the Multipurpose Container (MPC) then took hold, trying to capitalize on the idea of a large rail container that would increase the payload per container and have the advantage of bringing some uniformity to the cask designs, though the more it was studied, the less uniformity seemed possible because of the variability in fuel types. The MPC, certified for transport, storage, and disposal, would be loaded with spent fuel assemblies and welded closed at the reactor. The large containers then would be emplaced horizontally in drifts underground at Yucca Mountain. This concept was terminated in 1996 for policy reasons, but also for an important technical reason. Because of the provisions of the DOE's Standard Contract with utilities (10 CFR Part 961) requiring accepting "oldest fuel first" (which actually means only the oldest reactors were served first), DOE would have no control over the thermal output of the MPCs as they arrived at the repository for underground emplacement. Thermal output of individual assemblies varies as a function of original uranium enrichment percentage, bum-up time in the reactor, and age out-of-reactor. For technical reasons associated with Yucca Mountain repository rock stability and waste form integrity, DOE had to be able to set limits on, and control the thermal characteristics of the stream of waste packages placed in a repository drift. The MPC represented an unsolvable logistics problem for repository loading and thermal management.

The next idea was to bring the spent fuel assemblies to the Yucca Mountain surface facility in newly designed high-payload shipping containers, offload the assemblies into a large, 5,000 metric ton capacity lag storage pool, and then select individual assemblies, based on their thermal characteristics, to be grouped into a disposal container for underground emplacement. In this way, the thermal output of individual containers and the emplacement stream into a disposal drift could be "tailored."

But, concerns over the safety of the lag storage pool and other transfer pools at the Yucca Mountain surface facility led to a conceptual change in which hot cells would be used for fuel assembly transfers from transportation containers either directly to disposal containers or to storage containers for later assembly selection to maintain the flexibility for thermal "tailoring" of the individual containers and the stream of containers. This is operationally complex and requires rigid controls—but is not impossible.

Then, an analysis indicated the possibility of severe radionuclide contamination and worker safety problems from handling damaged fuel assemblies in the hot cells. Some existing spent fuel is known to be damaged and is a potential contamination source. Also, the expectation is that there is other damaged fuel, though its condition is unknown, and fuel could also be damaged from vibration during transport. This leaves the uncertainty of hot cell contamination and worker safety essentially unknowable for purposes of a safety analysis.

Attempts to resolve this contamination problem apparently were not satisfactory, because the most recent conceptual change, resulting in the current redesign effort, involves elimination of normal operation bare fuel assembly handling in hot cells at the repository surface facility. Instead, the plan is that commercial spent fuel will be loaded into canisters that are welded closed at the reactors, then placed in a transportation overpack for delivery to Yucca Mountain. In the so-called "clean" facility, the welded canisters would then be placed in disposal overpacks for direct emplacement or in storage overpacks for later selection for emplacement. This concept is called "TAD" (Transport, Aging, and Disposal). It has all the same logistical drawbacks as the MPC concept, but adds an "aging," i.e. storage, facility of at least 21,000 metric ton capacity.

Once the current redesign is complete, it will have to meet the DOE's administrative review requirements and process in order to be incorporated into the project baseline. It will have to be integrated into the project design and safety case, and its effect on the Total System Performance Assessment will need to be evaluated, because a change in the waste package would be a result of the conceptual change.

In effect, this concept not only revives the failed concept of the MPC program, but calls for the equivalent of a Monitored Retrievable Storage facility at Yucca Mountain, despite the fact that placement of such a facility in Nevada is prohibited by the Nuclear Waste Policy Act as Amended, as long as a repository site is under consideration in the State. Nevada, in the past, has rejected such an attempt, by Congress, and the Presidential veto of the bill to develop Interim Storage at the Nevada Test Site, Yucca Mountain's front door, was sustained.

Uncertainty about the EPA standard:

Nearly nineteen years ago, on June 29, 1987, the DOE Project Manager for the Yucca Mountain site told this Committee:

"The process of doing the modeling and calculations that estimate the radioactive releases from the [Yucca Mountain] repository tells us that we may be five orders of magnitude below a very conservative EPA standard." He added, "[I]t is not conceivable to me that we would discover something of a major nature that would cause us to change our mind about it [suitability of the site]."

Just five years later, it was clear that the Yucca Mountain site could not meet the EPA standard with respect to atmospheric releases of radioactive carbon-14. After efforts to have EPA relax its standard failed, DOE appealed to Congress, which resulted in a mandate for a new EPA standard, specific to the Yucca Mountain site, as part of the Energy Policy Act of 1992. The direction to EPA is as follows:

"[EPA] Administrator shall, based upon and consistent with the findings and recommendations of the National Academy of Sciences, promulgate, by rule, public health and safety standards for protection of the public from releases from radioactive materials stored or disposed of in the repository at the Yucca Mountain site. Such standards shall prescribe the maximum annual effective dose equivalent to individual members of the public from releases to the accessible environment from radioactive materials stored or disposed of in the repository." Section 801(a).

As instructed, EPA contracted with the National Academy of Sciences (NAS) for a report of findings and recommendations to be titled *A Technical Bases for Yucca Mountain Standards*, which was published in 1995. Among other things, the report found that there is no scientific basis to limit the repository compliance period to 10,000 years as had been done in the original EPA standard; and, its recommendation: "We recommend calculation of the maximum risks of radiation releases whenever they occur as long as the geologic characteristics of the repository environment do not change significantly. The time scale for long-term geologic processes at Yucca Mountain is on the order of approximately one million years." Page 71-72. The one million year period is referred to in the report as the period of geologic stability during which, the report concluded, it is feasible to make a compliance assessment. The report also noted that, "In the case of Yucca Mountain, at least, some potentially important exposures might not occur until after several hundred thousand years." Page 55.

In June 2001, EPA promulgated its rule, Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada (40 CFR Part 197). The rule set a regulatory period of 10,000 years for compliance with EPA's maximum individual dose standard, which was set at 15 millirems per year. A separate groundwater protection standard was also set for the 10,000 year regulatory period, with dose and radionuclide concentration limits consistent with Safe Drinking Water Act standards that apply to all of the nation's public drinking water supplies. The rule did acknowledge that peak expected doses could occur after the 10,000 year regulatory period and required DOE to calculate the peak individual dose during the period of geologic stability after 10,000 years and include the results in the Yucca Mountain Environmental Impact Statement "as an indicator of long-term disposal system performance." But, the rule further states, "No regulatory standard applies to the results of this analysis." Sec. 197.35.

Nevada and others (Nuclear Energy Institute, Natural Resources Defense Council, and several other environmental and public interest organizations) challenged the EPA standard in lawsuits filed in the U.S. Court of Appeals for the District of Columbia Circuit in summer 2001. Among Nevada's and others' issues was that the

setting of a 10,000 year regulatory period was not “based upon and consistent with” the findings and recommendations of the NAS, as required by the Energy Policy Act of 1992. The Court upheld this challenge and vacated that portion of the EPA standard that applied a 10,000 year regulatory period, as well as the portions of the NRC licensing rule (10 CFR Part 63) that adopted EPA’s 10,000 year regulatory period. *Nuclear Energy Institute v. Environmental Protection Agency*, 373 F.3d 1251 (D.C. Cir. 2004).

The premise of the NAS Technical Bases report is simple and straightforward—humans must be protected from the maximum radiation risk from a nuclear waste repository, whenever that risk is projected to occur. If this protection cannot be reasonably assured at the outset, the problem is with the selected repository site and design, not with the premise. EPA’s selection of a one million year regulatory period is a reflection of the NAS finding that compliance assessment is feasible through that time period for most physical and geologic aspects of a repository at Yucca Mountain, given our knowledge and understanding of the natural characteristics, features, and processes at Yucca Mountain and in the surrounding area. The wide range of possible assumptions about the longevity of the metal waste containers coupled with our current understanding of the physical and hydrologic characteristics of Yucca Mountain indicate it is very likely that the calculated peak individual dose will occur sometime during the million year period of geologic stability.

If there were no metal containers and shields protecting the waste from infiltrating water, DOE’s calculations for time of peak dose (in the Site Recommendation performance assessment) put the average peak at about 2,000 years after repository closure. Using DOE’s optimistic projections of the rate of container failure, the performance calculation shows the time of peak dose at between 200,000 and 300,000 years after closure. The magnitude of the calculated peak dose, in both cases, is approximately the same, and both far exceed 15 millirems per year. In the case with no metal waste containers or shields, a 15 millirem per year standard would be exceeded within 500 years after closure of the repository.

The compliance test for a repository is whether there is reasonable expectation that the statistical maximum dose (or risk) to humans from releases from the repository fall within a pre-established regulatory dose limit. It is of great importance that the complex performance calculation is scientifically credible because the compliance decision is to be made prior to waste emplacement. After the waste is disposed and the repository is sealed, the performance calculation has no relevance as to how the repository will actually perform and when the maximum dose to individuals will occur. It could appear in as little as a few thousand years. The wide range of uncertainty in projected repository performance is dominated by the great uncertainty in the failure rate of the metal waste containers, not the geology and hydrology. Once the waste containers begin failing by corrosion, the contamination of the groundwater will be relatively rapid, far reaching, and irreversible. Radionuclides from waste disposed at Yucca Mountain will eventually reach the land surface both through groundwater pumping and through natural playas and springs where groundwater that has traveled beneath Yucca Mountain reaches the land surface today.

EPA has indicated it would like to have its final Yucca Mountain standard in place before the end of this calendar year. But this does not alleviate DOE’s uncertainty about the final rule, as it relates to the need for revisions in its Total System Performance Assessment. If the EPA standard were to become final in the form proposed, DOE would need to revisit the features, events, and processes that previously were excluded from consideration based on their possible effect on performance, or their likelihood of occurring during the 10,000 year compliance period. A credible climate representation also would need to be constructed for a 1 million year compliance period. And the great uncertainty is whether the final EPA rule will withstand legal challenge, should the numerous vastly unprecedented elements of the Proposed Rule be promulgated as the final standard.

Early in EPA’s rulemaking process, Nevada proposed a straightforward approach to meeting the Court’s ruling: simply extend the 10,000 year compliance period for the standard as written to the time of expected maximum dose (risk), whenever that occurs in DOE’s Total System Performance Assessment. From the Court’s perspective, this is what should have been done in the first place. Nevada’s proposal was notably absent from the list of alternative approaches considered by EPA for its rulemaking, and EPA exacerbated the uncertainty about a final Yucca Mountain standard by introducing a two-tier, bifurcated compliance standard and time period.

Improve the “nuclear culture” of the Yucca Mountain Project:

In order to be considered for a license from NRC, DOE must demonstrate that it will be a fit and responsible licensee. This requires that protection of human

health and safety, and the environment must consistently be held as the highest priority in decision-making. This attribute can only be judged on the decisions and actions of the entire Yucca Mountain organization, as demonstrated in its pre-license application behavior. Given the high level of verbal importance applied to this matter by top DOE managers, along with the observations of the DOE Inspector General, and consistent 20-year history of GAO's finding of persistent managerial deficiencies in the project, it is clear that the goal is, at least, elusive for the Yucca Mountain project organization.

CONCLUSION

Energy Secretary Bodman recently said that the nation's high-level nuclear waste program is "broken." This invites some important questions. When did it break, and when was the break detected? What broke—was there a weak link, or a system failure? Can the break be patched or repaired, or is it beyond repair? If it is beyond repair, is there a need to replace it—and, if so, with what?

Assuming the answers to the above questions led to the crafting of plans for resuscitation, rehabilitation, and remediation of the Yucca Mountain project, a problem remains for which no resolution can exist. The site does not have the necessary geologic and hydrologic attributes to support a demonstration of the capability for safe, permanent disposal of the nation's high-level nuclear wastes—the goal of the Nuclear Waste Policy Act.

Three times in the past 15 years, Nevada Governors have advised Secretaries of Energy and finally the Congress that the site should be disqualified under DOE's original Site Recommendation Guidelines, because of its geologic and hydrologic deficiencies. Despite DOE's own analyses finally vindicating Nevada's basis for this claim, the DOE's response was to eliminate relevant disqualification factors through issuance of new guidelines just prior to its Yucca Mountain repository Site Recommendation to the President. The Yucca Mountain site model, upon which the Project Manager expressed such confidence to the Committee in 1987, was shown to be wrong, first in 1992, and again in 1996, both times through data collected at the site. The Yucca Mountain site so optimistically portrayed to Congress in 1987 is scientifically not the same site before you today. Yucca Mountain cannot meet any reasonable test for long-term safety.

You asked for testimony in this hearing on the status of the Yucca Mountain Repository Project within the Office of Civilian Radioactive Management at the Department of Energy. The request, in more practical terms is for information on how the Yucca Mountain project is doing in trying to make a convincing case for a safe repository at an unsafe site. The answer is, "Very poorly—because, even without all the problems described above, it is an impossible job."

Thank you for the opportunity to present our views before this Committee.

The CHAIRMAN. Thank you very much for your testimony. Now we will have questions from the Senators. We will start with Senator Bingaman.

Senator BINGAMAN. I want to thank you all very much. Thank you, Mr. Chairman. Let me go to Mr. Golan and ask you if DOE's—I know that this law, as signed 4 years ago, in 2002, contemplated the Department would be able to file a license application quickly, and that obviously hasn't happened. Could you explain a little better as to why you understand it's taking so long to get to a point where an application could be filed? Are there any statutory impediments to your going ahead and filing an application, or is this strictly a matter of internal administrative work that needs to be done?

Mr. GOLAN. Yes, sir, in terms of why this is so hard, the simple fact is that this has never been done anyplace around the world, and the requirements that the Department is expected to meet are a good set of requirements that we have to make sure that we meet.

If we look at some of the recent things that we need to resolve in submitting a license application, the first is we are developing the design and the license application to support the clean-canister

approach. We received the conceptual design from our contractor. We are reviewing it right now. We have a formal structure process to take that through our Secretary of Energy's Acquisition Advisory Board, and we are going to incorporate that into our baseline. So, we are—instead of handling their spent nuclear fuel, our intent is to handle most of the fuel in a canistered way.

Senator BINGAMAN. Let me just interrupt there. About a decade ago, there was a program called the multi-purpose canister and that was canceled, and now you have the Transportation, Aging and Disposal canister; how do those differ?

Mr. GOLAN. At the heart of it, they are basically the same. A multi-purpose canister would allow the canister to be used for a number of different functions: for transportation, for aging, and potentially, and ultimately, for disposal. The Transportation, Aging and Disposal canister seeks to add disposal to what we have today.

We have canisters that have been licensed for aging, spent nuclear fuel to be aged in, and we have—the same canisters are licensed to be transported, and we are seeking to extend that license to allow that canister to actually be licensed for disposal, where we wouldn't have to open it up.

Mr. BINGAMAN. I'm still unclear as to why we canceled the multi-purpose canister a decade ago. It seems like we have now come up with a multi-purpose canister as the solution to the problem we've got.

Mr. GOLAN. Sir, there was a report issued by EPRI around the time the multi-purpose canister project was canceled. Their conclusion was that the canister in that approach was not canceled for any technical or financial reason. I would be happy to submit that report to the committee for the record.

Senator BINGAMAN. But if it wasn't a technical or financial reason, what kind of reason was it?

Mr. GOLAN. There was some indecision that the team pointed to that allowed this process not to go forward. But I think if you go back to the industry, if you just go back to the people who are familiar with this project, most of the folks who are familiar with nuclear material handling and waste handling look at this and say, "This is the right way to do it."

So, in a sense, we are going to take advantages of the lessons we learned from the multi-purpose canister approach, factor those in so we do have a canister that we don't have to be handling bare spent fuel several times, and that the utilities can actually pack once, and we don't have to open it up and repack it and unpack it. Then we can use this as a means to just dispose.

Senator BINGAMAN. But, in fact, we are not learning lessons from that experience. We are essentially starting up again where we left off. Is that right? I mean, we had a multi-purpose canister program and you say for indecision reasons we canceled it a decade ago. We now have essentially a multi-purpose canister program again and it is basically the same thing, we are just at the conclusion this time; is that accurate or not?

Mr. GOLAN. That is one way to look at it, sir. This time, what we are doing is we are involving industry and we are involving the utilities early-on, up front. We are confident that this approach is going to end up with fewer times that we handle the spent fuel.

It is going to involve a safer operation at Yucca, so we are confident that we can take the Transportation, Aging and Disposal canister and make it work.

Senator BINGAMAN. My time is up, Mr. Chairman. Thank you.

The CHAIRMAN. Thank you, Senator. We will stay with you, Mr. Golan.

The fuel from our nuclear Navy is destined to be disposed of at Yucca Mountain; is that correct?

Mr. GOLAN. Yes, sir, it is.

The CHAIRMAN. How much waste is currently planned for permanent disposition at Yucca Mountain?

Mr. GOLAN. The legislative cap on Yucca Mountain is 70,000 metric tons. There is a Defense portion which includes the Navy. The Defense portion right now consists of 7,000 tons of Defense waste which would go to Yucca Mountain. There is, however, 14,000 tons of Defense waste, which has been generated, or will be generated, that is not only from the Navy, which represents less than 100 tons, but also from the spent nuclear fuel and reprocessed waste that is at Savannah River, Idaho and at Hanford.

So there is 14,000 tons of defense waste, and 7,000 of those tons would go into Yucca Mountain. All the Navy's waste would be planned to go into Yucca Mountain, which again represents less than 100 tons.

The CHAIRMAN. Their current schedule—when would this waste be ready for shipment to Yucca?

Mr. GOLAN. Sir, there is some waste that is more ready for shipment and there is some waste that is going to require additional steps before it would be ready for shipment.

Some of the fuel that is at Hanford today, which is in multi-canister overpacks, the glass waste, the vitrified waste which has been produced down in Savannah River through the Defense Waste Processing System, and the waste that—the spent nuclear fuel that has been generated by the Navy's nuclear propulsion program could be ready to be shipped as early as the first part of the next decade.

Some of the other waste is at Hanford and at Idaho, which is the reprocessed waste which still requires a next step. In a lot of cases, some of that waste is in liquid form today. It needs to be vitrified or solidified before it is going to be ready to be shipped, and until we get some more visibility on that front, Mr. Chairman, I don't want to necessarily speculate on when those wastes would be ready to ship.

The CHAIRMAN. Well, if Yucca was not available, how would this waste be handled?

Mr. GOLAN. As you mentioned in your opening statement, sir, the scientific community—the international scientific community has generally endorsed geological repository since 1957. Absent a geological repository, the only alternative, or one of the alternatives I think we have to look at, would be perpetual on-site storage.

Now the Department has initiated the Global Nuclear Energy Partnership, which looks at using some of this waste and recycling it. Some of that waste though, sir, can't be recycled because it already has been recycled one time, and that is a lot of the Defense waste.

The CHAIRMAN. A lot of which?

Mr. GOLAN. A lot of the Defense waste that's at Hanford and at Savannah River. It has already gone through the reprocessing for the weapons production mission.

The CHAIRMAN. And it can't be recycled, one of the modern concepts of recycling?

Mr. GOLAN. Maybe it can, but under current technology—remember this waste has already been reprocessed once, so it represents the glass waste, the vitrified waste that's at Savannah River, sir.

The CHAIRMAN. I have many additional questions, but I am going to yield and stick around here awhile anyway.

Senator Burr, you have been here a long time. I am going to yield to you now for your questions.

**STATEMENT OF HON. RICHARD M. BURR, U.S. SENATOR
FROM NORTH CAROLINA**

Senator BURR. Thank you, Mr. Chairman. Let me thank all the witnesses for being here. Mr. Golan, thank you for a very, very difficult job.

Mr. Wehrum, I think it is likely that your plan will be litigated as well; do you agree?

Mr. WEHRUM. I agree, Senator.

Senator BURR. And I think Mr. Loux, as I understood your statement, you will litigate—the State of Nevada will litigate when DOE files an application?

Mr. LOUX. We will challenge the application, that is correct.

Senator BURR. Sure. Now, we are back in a situation where we are focused on canisters. We have no firm date for our expectations of the license application. We are at 55,000 metric tons of waste, today, of on-site storage. An additional 7,000-metric-tons-plus of DOE waste. We have a limit, 70,000 metric tons, but by my calculations of about 2,200 metric tons a year, we are reaching 2010.

By 2010, the likelihood is we haven't finished the litigation on the final rule; we probably haven't filed the application, so you haven't litigated yet, and the current waste will fill the capacity design of Yucca Mountain. In 1987, Congress selected Yucca Mountain, 19 years and \$18 billion of rate-payer money later, not one canister is in the ground. We are here with a similar set of issues that I think probably they thought about very early on in this project.

A State like mine in North Carolina, where the population is expected to explode, and we are beginning to see it, has tremendous demands in the future for electricity generation. I can't see how that happens in North Carolina, or any other State, without the majority of that being new nuclear generation.

It is impossible for me to believe today that we will have a commitment to new nuclear generation if we have not settled the question of what we are going to do with that spent fuel. The likelihood is that we are not going to settle it by 2010, based upon the scenario I just gave you. If my calculations are right, were we to settle this tomorrow, we have got enough waste already to fill it up. Then, potentially, shareholders will not be too excited if their companies go out and commit to their new nuclear plants.

I would suggest to you, Mr. Golan, that maybe the single most important thing is not necessarily the work that we are currently doing on Yucca, it is what's next. Are we going to be here 20 years from now—and I realize you won't be here. I will promise you, I will not be here.

Dr. Garrick, you are unbelievably generous to commit to be on a project that I think at times must seem like it spins its wheels to some degree. The same with everybody else.

The challenge is where do we go from here? I am not here to pour water on anybody's parade. I am here to say, at what point do we collectively—not just Members of Congress, but do we collectively look at this and say, "You know what, we have got to think of something else." Should we, as the chairman suggested, look at reprocessing the nuclear waste within? We understand the 7,000 metric tons that may have already been reprocessed. Technologically, aren't we at a different level than we were in 1987 when we selected Yucca Mountain, many years after we designated some type of in-the-ground depository for this?

You are the experts, several of you. I challenge you to be leaders and not necessarily just to continue to head down the road that many have headed down before. They continued in the same direction because they knew they wouldn't be here when this happened.

My fear is it is never going to happen if, in fact, we don't think about all the components to it.

Mr. Chairman, there are obstacles that we have yet to address in this hearing. I am not going to get into the details. I think that for those that have been involved in it for a long time, they certainly know what those obstacles are.

I think the No. 1 issue is how long the litigation is going to take as it relates to this project. I am not excited that Mr. Loux and the State of Nevada would choose to litigate. They are not the only ones, so I can't single them out and chastise them in any way. This is a national problem, and if we don't solve this problem, the needs that we have for electric generation in the future, we will not be able to make.

So, I certainly do encourage you to try to find quick resolution to the canister issue, try to find quick resolution as to when the application process will proceed, and a timeline that we might be able to use with some degree of confidence. It might be presented to us, but more importantly, that which you have been charged with and that is what is next. I will tell you, we are there. Now is the time for that.

Mr. Chairman, I thank you.

Senator DOMENICI. Well, you were right on, and there is no doubt about it, and I'm sure Mr. Golan knows that. One of the questions that should be asked, obviously is, "Is it already time to be looking at the next repository, under the statute?" I was going to ask the question, "How are we going about that at this point?" It is kind of ludicrous. We are looking at another repository under the statute of the same kind, under the same circumstances—or just what are we looking at? In any event, you placed the issues right before us, and I think we are going to have to get the answers sooner or later.

If you are finished, we are now going to go to Senator Bunning, then Senator Craig, then I will wrap it up in a half-hour or so.

Senator BUNNING. Thank you, Mr. Chairman. I would like my opening statement to be put into the record.

[The prepared statement of Senator Bunning follows:]

PREPARED STATEMENT OF HON. JIM BUNNING, U.S. SENATOR FROM KENTUCKY

Nuclear energy accounts for nearly 20 percent of America's electricity. Looking at Energy Information Administration forecasts, it is clear we are going to need large growth in coal, nuclear, hydropower and other sources of energy to fuel our economy and provide reliable power for our citizens.

Since the Three Mile Island accident in 1979, no new nuclear plants have come online in America.

Yet recently, utility and nuclear energy companies have entered into partnerships planning nearly 20 new, nuclear power plants. The Energy Policy Act we passed last year had incentives for nuclear energy and I'm proud that we are already stimulating investment.

These new power plants—as well as the many already operating—were promised a national repository for spent fuel. The Federal Government collects nearly \$750 million a year from nuclear power plants to pay for this proposed storage.

Last month, Secretary Bodman sent proposed legislation on this issue to Congress. I look forward to working with the Department of Energy to ensure that we have safe storage and safe transport of nuclear waste. We owe it to people in the 39 states that currently store nuclear waste and their neighbors who will help shipments move to Yucca Mountain to finish this project as safely as possible.

The bottom line is we need to complete this project. We have spent too long mired in debate.

We made a promise to the states and nuclear industry to store the nation's nuclear waste safely. It is time we deliver on that promise.

I look forward to the testimony of the witnesses before us today.

Thank you, Mr. Chairman.

The CHAIRMAN. It will be made a part of the record. Thank you, Senator.

Senator BUNNING. Richard, I couldn't have expressed a more similar pattern. I have been here since we have been talking about Yucca Mountain in the Congress of the United States, and I am not going to lay blame on this group that is at the table because a different group has been at the table many times and given us many excuses for not getting the job done.

The Congress of the United States has an obligation to get the job done, and we don't need bureaucrats getting in the way, constantly, of the law that was passed in 1987 and expanded on.

I've heard a lot of excuses come out of the table. The same excuses came out of the prior tables that were before the Congress. If you want to accomplish the goal of a depository that we can actually put things into, I would question the State of Nevada's legitimacy, because they don't want this place there, and the fact of the matter is if they don't want it, where is it going, because all of the representatives that represent the 50 States have voted to put it there?

The Department of Energy has dragged their feet. And you are not the one that has dragged your feet, but from the beginning, they have dragged their feet. The EPA has dragged their feet. All of the people involved at the table have found reasons for not completing the project.

Switching from one canister to another just because it wasn't storable and using that excuse, saying, "Now we are going to start over, and now we are going to do X, Y and Z with the canister." I mean, give me a break. That is not even feasible if you are look-

ing from our side of the table and looking to get the job done for the United States of America and the American people.

We are to the limit of what we can even put in Yucca Mountain, and it isn't even open to do it. And now you are talking about a second depository. I mean, do you know how foolish that looks to the American people?

And Mr. Loux, you complained in the testimony that the Yucca Mountain project has been continually delayed. I just said that. I am frustrated with these delays, but ultimately, many of these delays are a direct result of the effort to ensure that the people of Nevada and all Americans are as safe as possible.

Rather than go back through these changes, do you think it would be more productive for all of us to work with DOE to complete this project as safely and quickly as possible?

Mr. LOUX. Senator, I don't believe that Nevada is doing anything that Kentucky, North Carolina, or any other State would not do, given the same circumstances of seeing an out-of-control agency that has a blatant disregard for public health and safety.

Senator BUNNING. Unfortunately, you are wrong, because Kentucky didn't resist. We had a Superfund project, and now we are charged with the responsibility of taking care of it for the first—the Federal Government is for the first 25 years and then Kentucky inherits the responsibility even longer than a million years, as long as the planet exists. So you are wrong.

I understand you still have concerns to address. How is the State of Nevada working with DOE to get Yucca Mountain on-line safely? And what, if anything, do you need from Congress to help make your partnership work?

Mr. LOUX. The answer to the question is the State is not working with the Department of Energy to make the project work.

Senator BUNNING. That is the 20-year process. I yield, Mr. Chairman. I have had my time.

Mr. CRAIG. Well, thank you, Mr. Chairman. I have as much reason as the Senator from North Carolina or the Senator from Kentucky to be pessimistic or frustrated. I am going to try and remain optimistic, because I believe Yucca is needed and I think that based on all of the legacy waste and those that have been spelled out, as are current and available for being identified, conditioned and placed in a permanent repository, that we need Yucca, even though we move forward with new approaches to new waste coming in and this next generation of nuclear reactor that we are talking about.

Mr. Loux, I read your testimony. I have always been fascinated by Nevada. I understand the politics of your State reasonably well. I also understand that when you use rhetoric like "out of control agency," that is good rhetoric in Nevada, because that is what you are giving us today.

It is bad rhetoric here, as far as I am concerned, because I don't see DOE as an out-of-control agency or the Nuclear Regulatory Commission as out-of-control. They are probably the most controlled we have, for all of the obvious reasons.

I must tell you, though, that when you talk about milestones missed and short-falls in funding and all of this kind of thing,

that's largely been a direct result of Nevada's delegation effort here.

When DOE didn't get its work done, in part it was underfunded, in part because—and so I am sitting here and I try to do this with a smile on my face. It is kind of like a child killing his parents and then throwing himself on the mercy of the court now that he is an orphan. It really doesn't track very well here. I know your mission—you just said it—to deny Yucca to ever come on-line. That is reality. That is the politics of your state. I understand that. So, we will try to work around you, but in the process of working around you, Yucca Mountain will be by far the safest repository every designed by man.

In fact, the design that has been proposed probably is beyond man's capability. I am not sure that we get to the 10,000-year mark.

Senator DOMENICI. A million.

Mr. CRAIG. No, a million. The odds are out there. Anyway, Mr. Golan, part of the waste that the Chairman was talking about and the waste that is in Idaho in part is conditioned for exit on an agreement that Idaho has with DOE. And this is Navy waste. It is what we have. It's Three Mile Island waste. We have old reactor waste, about 65 metric tons of it slated at the INL to move to Yucca when completed. The agreement says that will be done by 2035. Are we on schedule?

Mr. GOLAN. Sir, I am very familiar with the settlement agreement regarding the waste at your site and the fact that the settlement agreement requires the waste be removed by 2035. We also have a sodium-bearing waste and the calcine waste, which is also covered in the settlement agreement. We are working right now—first things first—to put together a technical basis to operate Yucca Mountain, and that is with the clean canister approach.

Later this summer, we intend to come back to this committee and provide a licensing schedule on when we are going to get the license application filed for the NRC. You know, clearly 2035 is 30 years away. I will say that the waste that comes out of Idaho has some unique characteristics about it which makes it very good for early placement into Yucca Mountain. So what I would like to do before we talk about shipment schedule is, let's talk about a licensing schedule, and then let's talk about an opening schedule and then we can talk intelligently about how it is that we are going to take the waste out of your State and meet the requirements of the settlement agreement.

Senator CRAIG. Well, that is good to hear. Based on the history of this issue, I hope we've rounded the corner. I know that there are great many things on line to be done as it relates to your licensing application and licensing that allows us to do that.

It is my belief, and I think the belief of some, that Yucca is necessary, and a new approach is necessary down the road, partly because many of us don't believe that a geological repository in the future is the direction we ought to go in. We have seen a proposal out of the Department known as GNEP to develop a reprocessing burning approach to this waste.

How important is interim storage to the success of Yucca Mountain and does the Department see a need to tie interim storage with participation in the GNEP program?

Mr. GOLAN. Interim storage of waste, sir, is less important, moving Yucca Mountain forward and, I believe, more important for the future of nuclear energy in this country. If you just look at the timeframes required for us to have a license submitted, adjudicated by the NRC, the construction authorization, followed by the construction, and then the license to receive and possess, that is going to take several years under the best case scenario here.

We do understand that within the commercial utilities, they are running to capacity limitations for on-site, continued storage. We did—the Department has done two things recently. The first is the Global Nuclear Energy Partnership, which I think addresses a lot of the concerns about recycling the waste. Even going through recycling, you are still going to need Yucca Mountain. You are still going to need a geological repository because no recycling is ever perfect, and there is going to be a waste by-product.

The other thing that the Department recently did is introduce legislation. Senator Domenici, I believe, introduced that by request. One of the things that the proposal didn't include was interim storage. The Department continues to have an open mind on interim storage, and the House of Representatives, in their subcommittee mark-out did provide, at least in their initial mark, some \$30 million to this program to look at interim storage in 2007. So, the Department has an open-mind on that and will continue to work with both Houses on that.

Senator CRAIG. Well I thank you.

Mr. Chairman, let me turn this back to you. I understand we have votes at or around noon and you have a good number of questions. I have a few that I may submit in writing. But again, thank you for the hearing. It is critical that we stay abreast of this issue as we work with all of you and the State of Nevada, and I mean that most sincerely.

We know that Nevada is a reluctant host at this time, but they have been the large beneficiary, historically, of DOE and our nuclear programs. It is a legacy that I guess now has found the State in denial. That is understandable and we thank you.

And I thank you, Mr. Chairman.

The CHAIRMAN. Senator Craig, thank you for your observations, sir. We do have a vote at 12. I have about 25 questions. I am going to submit all of them to you even though I wasn't going to. I am going to ask you to answer all of them. There are many technical ones. There are others that are philosophical.

I believe that we are going to receive statements from Senators Reid and Ensign, and I would request that they be made part of the record as if they were here and as if they were read.

[The prepared statement of Senators Reid and Ensign follow:]

PREPARED STATEMENT OF HON. HARRY REID AND HON. JOHN ENSIGN,
U.S. SENATORS FROM NEVADA

We want to thank the Chair, the Ranking member, and other members of the Committee for the opportunity present testimony on this issue, which is very important to us, our home State of Nevada, and the rest of the country.

The proposed Yucca Mountain nuclear waste repository will never be built because of the numerous and insurmountable scientific, safety and technical problems with the site. In addition, nearly three decades of poor management and oversight have demonstrated that the vast body of scientific and technical work done by the Department of Energy (DOE) and its contractors, much of which is incomplete or moot due to constantly changing designs of, and plans for, the repository, do not meet scientific standards.

In 1982, Congress passed the *Nuclear Waste Policy Act* to address the difficult issue of storing such waste. The Act called for disposal of nuclear waste in a deep geological repository that would remain stable for thousands of years and directed the Department of Energy (DOE) to study a number of sites in detail and pick the most suitable site based on the natural features of the site. The Act instructed DOE to develop a list of natural, geologic features that constitute a safe repository, including factors pertaining to rock characteristics, hydrology, proximity to water supplies and population, and seismic activity. Some of these criteria specifically disqualified any site that would require complex engineered measures to prevent groundwater flow through the repository or damage from earthquake activity, both of which are concerns at Yucca Mountain.

In 1987, Congress took action based on political expediency and limited DOE's studies to Yucca Mountain, in spite of the criteria in the Act that would disqualify the Yucca Mountain site. DOE has been studying the site for 20 years. While these studies are incomplete, what they have shown thus far is that Yucca Mountain is not a safe site for storing nuclear waste. Nor have they shown that spent nuclear fuel can be transported safely and securely across America's highways and railways and through our communities, past our schools and hospitals and through major metropolitan areas.

Transportation of nuclear waste around the country and to Yucca poses hazards to public health, economic and national security and environmental safety from accidents and terrorist attacks, which DOE has not addressed. Moving 77,000 tons of waste to Yucca would involve about 53,000 truck shipments or 10,000 rail shipments over 24 years, through counties in which nearly 250 million people live, including Sacramento, Buffalo, including Denver, Chicago, Washington, D.C., and Las Vegas. That is an average of approximately 2,800 shipments of deadly radioactive waste each year, will be rolling through neighborhoods in 43 states and hundreds of major metropolitan areas on its way to Nevada for the next several decades.

A few of the scientific problems that we have seen the last year and a half are:

- In 2004, the Court of Appeals threw out the Environmental Protection Agency's (EPA's) first radiation protection standards for Yucca because they were not strong enough to protect the public from radiation exposure and failed to follow the recommendations of the National Academy of Sciences. In 2005, EPA published its revised standards for the proposed Yucca Mountain high-level waste dump, which are wholly inadequate, do not meet the law's requirements and do not protect public health and safety. In fact, EPA is proposing the least protective public health radiation standard in the world. It would allow 1 in 10 women to contract cancer, and 1 in 20 to die from it.
- Nearly three decades of scientific and quality assurance problems with transportation plans, corrosion of casks, the effectiveness of materials, etc., causing DOE suspend work on the surface facilities and NRC to issue a stop work order on the containers.
- In addition, DOE revealed that documents and models about water infiltration at Yucca Mountain had been falsified. While the individuals who falsified this data were not criminally prosecuted, the DOE Inspector General's report and numerous reports from the General Accounting Office demonstrate that DOE continues to ignore falsification of technical and scientific data on the project.
- Nearly 10 years past its congressionally mandated deadline, DOE has still not submitted a license application, and DOE has not set a date except to say that one is not expected for several years, at the earliest.

Because the scientific, technical and safety problems with the proposed Yucca Mountain repository cannot be fixed, DOE prepared a legislative package that will remove these health, safety, scientific and safety requirements. Senators Domenici and Inhofe introduced this proposal, S. 2589, *The Nuclear Fuel Management and Disposal Act*, at the request of DOE in April. This bill is a complete admission that the project is a complete public health, safety and scientific failure.

However, DOE has not yet provided Congress with its detailed statement on this legislation as required by the *National Environmental Policy Act* Section 102(C) (43 U.S.C. 4332(C)). Today, we are sending a letter to DOE requesting this analysis. We expect that DOE will supply us with this analysis as it is required to do by law

in order to enable Congress to impartially analyze the impact of DOE's proposal before any action is taken on it.

It should be clear to anyone that the proposed Yucca Mountain project is not going anywhere. Yucca Mountain will never open. Yet we must safely store spent nuclear fuel. It is time to look at other nuclear waste alternatives. Fortunately, scientists agree that the technology to realize a viable, safe and secure alternative is readily available and can be fully implemented within a decade if we act now. That technology is on-site dry cask storage. Dry casks are being safely used at 34 sites throughout the country. NEI projects 83 of the 103 active reactors will have dry storage by 2050.

That is why we have introduced a bill that would safely store nuclear waste while we look for a scientifically-based, safe solution: *The Spent Fuel On-Site Storage and Security Act of 2006*, S. 2099. Our bill requires commercial nuclear utilities to secure waste in licensed, on-site dry cask storage facilities.

There is absolutely no justification for endangering the public by rushing headlong towards a repository that is fraught with scientific, technical and geological problems when it can be stored safely and securely in dry casks. Our bill guarantees all Americans that our nation's nuclear waste will be stored in the safest way possible.

It is time we addressed the problem at hand—the safe storage of spent nuclear fuel—and stopped pouring taxpayers' money down the drain on a project that could endanger all of our citizens.

The Yucca Mountain project is a failure. We vow to continue to fight this project.

The CHAIRMAN. I am intrigued by the fact that the United States of America is obviously going to have to engage in recycling. And the question now is going to be, during the next 24 months, in my opinion, what the level of interest and gusto the United States has in recycling, because recycling is going to determine which way—what kind of an ultimate repository we need. It won't solve the problem of the interim storage, but clearly, if we are going to have a robust recycling program, then clearly we need a completely different Yucca Mountain configuration with reference to what we put into Yucca Mountain and what we need of a Yucca Mountain. And it may very well be a man at the table that we generally look to as our—not our friend, maybe—looking with us at what happens to the recycled product when we, 25, 30 or 40 years from now, have to place it somewhere and probably will be putting it in Yucca Mountain.

My informed guess today is that it will not be so objectionable to Nevada when that time comes. But who knows. We will wait and see. That is such a different world that it might give us a chance to start over and rethink what we are going to do.

In the meantime, confusion is rampant, timeframes are out of whack, and the administration's bill, which I introduced because they asked me to, has a big vacuum in it, as it does not address interim storage. And besides, it addresses the licensing of a process which may not be relevant, as I indicated, because it is completely different from what I am talking about here when we speak of reprocessed material. And because it is not talking about that kind of a program—and indeed, we have to really seriously think about whether we can reduce to legislation what I am talking about, because it will be in such a long term that it will be hard to put that together.

Nonetheless, I thank all of you for your testimony. I don't know how informative the hearing has been, but determinative, obviously, it has not been, for we have completed little or nothing today except that things are very confused and are not anywhere near a conclusion. And last month, I introduced, at the President's re-

quest, his package to begin a dialog putting it back on track. Taking from what we have learned today, and in reviewing the testimony, and obviously the answers to the questions, coupled with the administration's proposal, I am going to work very hard with Senator Bingaman and our joint staff to see if we can come up with some common ground to move forward on answering the spent fuel questions.

I am very hopeful that we can. It is delicate and it is extremely hard to think legislatively in the lengths of time that are going to be needed for this recycling to take effect and produce the type of substance that we need and the quantities we need to take the place of spent fuel rods. And I guess I will close the hearing by saying it ought to be pretty clear to everybody that we are not going to be putting spent fuel rods in Yucca Mountain. I don't know whether that is the way to end the hearing, but to me it is quite obvious that that isn't going to work for many reasons.

So, we are kind of kidding ourselves, but we don't want to give up, because there is somewhere in this a solution that does involve a Yucca Mountain. It will certainly be a different Yucca Mountain than we have been talking about, but it will be a Yucca Mountain nonetheless.

Having said that, I am going to recess. Thank you everybody. We stand adjourned.

[Whereupon, at 11:57 a.m., the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Questions

U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD,
Arlington, VA, June 8, 2006.

Hon. PETE V. DOMENICI,
Chairman, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

DEAR SENATOR DOMENICI: On behalf of the U.S. Nuclear Waste Technical Review Board, I want to thank you and the members of the Energy and Natural Resources Committee for inviting the Board to testify at a hearing on the status of Yucca Mountain on May 16, 2006. As I mentioned in my testimony, an important part of the Board's mandate is providing information on the Board's technical and scientific evaluation of DOE activities to decision-makers in Congress.

Enclosed are the Board's answers to questions submitted for the record that were forwarded to the Board with your letter of May 18, 2006. The Board hopes that the technical information in the answers will be useful to the Committee.

Sincerely,

B. JOHN GARRICK,
Chairman.

[Enclosure.]

RESPONSES OF B. JOHN GARRICK TO QUESTIONS FROM SENATOR DOMENICI

Question 1. The Nuclear Waste Technical Review Board has, on many occasions, pressed DOE to better address uncertainties in its long term analysis of Yucca Mountain.

Answer. Over the years, the Board has acknowledged that uncertainties in predicting repository performance are inevitable because of the first-of-a-kind nature of the endeavor, the complexity of the site geology, the implications of high temperatures from radioactive decay of spent nuclear fuel and high-level radioactive waste, and the long timeframes involved. The Board also has indicated the need for understanding better the potential behavior of the repository system and for the Department of Energy to (DOE) to supplement its understanding with additional lines of evidence.

DOE uses a probabilistic approach in estimating repository performance that incorporates uncertainties and sensitivity analyses in its performance assessments. However, the Board is not yet convinced that the assessments are realistic. The Board has asked for a realistic analysis of repository performance so that it can judge the extent of conservatism and uncertainty in DOE's total system performance assessment (TSPA). In addition, the Board has recommended that DOE make its uncertainty analyses more transparent to better expose specific contributions to uncertainty, such as the effect on performance of localized corrosion of the waste packages.

Question 2. You have not seen the final license application, but, in your opinion, what are the greatest uncertainties with the application? Are these the result of the quality or absence of data, or the fundamental difficulty in predicting the behavior of the mountain over these incredibly long time periods?

Answer. The Board evaluates the technical validity of work undertaken by DOE. On the basis of that evaluation, the Board's view is that the most important technical and scientific uncertainties related to the post-closure performance of the re-

pository are the release rate and chemical form of dose-contributing radionuclides leaving the engineered barrier system, the extent to which components of the natural system contribute to waste isolation, and the implications of high temperatures for repository performance, including the potential for localized corrosion of the waste packages.

There also are logistical and practical challenges, as well as temperature considerations, associated with pre-closure activities, including implementation of DOE's transportation, aging, and disposal canister concept; designs for repository surface facilities; and operational plans.

More data could help address some of these uncertainties. It is important to note that new information may show that the various repository components perform better or less well than currently projected. Either way, performance estimates would be more realistic and therefore would engender more confidence. Estimating repository performance over long time periods can be a challenge. However, as the National Academy of Sciences pointed out in its report, *Technical Bases for Yucca Mountain Standards*, some uncertainties would increase over time and others would decrease. The key is to manage uncertainty so that it does not significantly affect the performance of the repository.

Question 3. Given these uncertainties, do you believe it is more likely that DOE's analysis over or under estimates radiation exposures in the distant future?

Answer. DOE uses TSPA as a tool for estimating whether a Yucca Mountain repository would comply with the regulatory standard. DOE believes that the performance estimates in its TSPA are conservative (i.e., that they underestimate how well Yucca Mountain would perform). The Board believes that the assumptions underlying DOE's performance estimates are a mix—most are conservative, others are realistic, and a few may be optimistic. Although this makes it difficult to assess just how conservative DOE's repository performance estimates are overall, the Board believes that the results taken as a whole may be shown to be conservative. The Board has urged DOE to develop a realistic performance analysis so that important information on this question can be provided to the public, decision-makers, and other affected parties.

Question 4. Can you tell us how the risks of disposing of used nuclear fuel in Yucca Mountain compare to the risks of leaving the material where it is for thousands of years?

Answer. It is the opinion of the Board that storing spent nuclear fuel at existing sites for thousands of years is not a desirable option when compared with permanent deep geologic disposal. Although temporary storage can be accomplished safely for decades, storing the waste indefinitely at reactor sites would require storage facilities to be monitored and maintained constantly and would require periodic replacement as facilities and components degrade with age. If those activities are not carried out faithfully for very long periods, the resulting risks to health and the environment could be significant. Having to manage a large number of high-level-waste sites also raises security issues. Disposing of spent nuclear fuel and high-level radioactive waste in a deep geologic repository would eliminate these concerns.

RESPONSE OF B. JOHN GARRICK TO QUESTION FROM SENATOR CRAIG

Question 1. Does the Board believe that there are outstanding scientific or technical issues so serious as to prevent the DOE from submitting a license application?

Answer. The Board has not explicitly addressed the question of what constitutes a reasonable basis for a license application. The Board's focus is on the soundness of the science and engineering supporting DOE's assessment of the performance of the total waste management system, including pre-closure and post-closure activities.

On the basis of its ongoing technical and scientific evaluation, the Board's view is that the most important technical and scientific uncertainties related to the post-closure performance of the repository are the release rate and chemical form of dose-contributing radionuclides leaving the engineered barrier system, the extent to which components of the natural system contribute to waste isolation, and the implications of high temperatures for repository performance, including the potential for localized corrosion of the waste packages. In addition, although DOE's new canister-based concept for transportation, disposal, and aging of spent nuclear fuel may have potential to reduce handling of the waste, the Board wants to understand better the feasibility of the concept, given the status of spent nuclear fuel in storage at utilities and post-closure temperature limits on the waste packages.

The Board has stated that resolving these issues appears "doable," provided that selected analyses and investigations are made to confirm the performance and operation of the repository. Furthermore, resolving all the issues before submitting a li-

cense application may not be necessary. However, addressing the issues might substantially increase confidence in DOE's operational plans and estimates of repository performance.

RESPONSE OF B. JOHN GARRICK TO QUESTION FROM SENATOR BINGAMAN

Question 1. You testified that while the DOE has made meaningful progress, serious technical issues remain unresolved. How long, in your opinion, will it take the Department of Energy to resolve those issues and be able to submit a defensible license application to the Nuclear Regulatory Commission?

Answer. The Board is on record indicating that resolving the issues appears "doable," provided that selected analyses and investigations are made to confirm the performance and operation of the repository. Some unofficial schedules have indicated that DOE will submit a license application sometime in fiscal year 2008. Although resolving all these issues before submitting a license application may not be necessary, addressing the issues has the potential for substantially increasing confidence in DOE's operational plans and estimates of repository performance. The Board has encouraged DOE to continue its technical and scientific investigations after the submittal of a license application to increase confidence in DOE's estimates of repository performance.

Question 2. Does the Board have any reason to believe that Yucca Mountain is not a technically suitable site for the repository?

Answer. The Board is not aware of any single condition that would automatically make the site unsuitable; however, the engineered components of the repository have to be integrated with the capabilities of the natural system so that they work together to isolate radionuclides. For example, if localized corrosion of the waste packages is shown to occur at high temperatures, it could have implications for repository design and performance. On the other hand, a more realistic model for mobilizing dose-contributing radionuclides following the penetration of the waste packages could reduce uncertainties in the timing and magnitude of the projected peak dose and could enhance the credibility of repository performance calculations.

Question 3a. As an authority on risk assessment, what is your view of the EPA's proposed radiation protections standards? Specifically

What is your view of EPA's decision to use a deterministic exposure scenario instead of the probabilistic approach recommended by the National Academy of Sciences?

Answer. EPA's and NRC's regulation of the program is outside the Board's purview, so I will answer the three questions as they were posed (as the personal opinion of John Garrick).

It is true that the prescriptive features of the regulations with respect to the dose calculations preclude a completely probabilistic or risk-based approach. This is why the Board has repeatedly asked for a realistic—that is, a traditional—"risk assessment" of the repository. I believe, however, that where the regulations are prescriptive, they are conservatively prescriptive. It should be noted that the EPA's individual protection standard is, to some extent, probabilistic. As the EPA stated when it finalized its revised environmental standards in 2001 (66 FR 32125), "By specifying the mean as the performance measure and probability limits for the processes and events to be considered (§ 197.36), and in concert with the intent of our 'reasonable expectation' approach in general, we have implied that probabilistic approaches for the disposal system performance assessments are expected."

Question 3b. What is the difference between the probabilistic and deterministic approaches?

Answer. Deterministic approaches are scenario-based and rely on single-valued choices of models and sets of parameters to estimate performance. Probabilistic approaches incorporate the likelihood that each of these and alternative models and sets of parameters are appropriate. The major advantage of a probabilistic approach is the ability to explicitly incorporate uncertainties and variabilities in the analyses. An analysis that incorporates uncertainties is essential to understanding risk.

Question 3c. How does EPA's 350 millirem standard between 10,000 and 1,000,000 years compare with other radiation protection standards adopted in this and other countries?

Answer. The Board is not aware of any countries that require a quantitative risk assessment to be carried out to the time of peak dose or one million years; typical periods for numerical analyses are on the order of 10,000 years. For today's activities and facilities, the International Commission on Radiological Protection and the National Council on Radiation Protection and Measurements both have recommended that radiation exposures to members of the public be limited to 100

mrem/yr from all sources (excluding medical and natural background). My personal opinion is that the EPA standard is reasonable.

DEPARTMENT OF ENERGY,
CONGRESSIONAL AND INTERGOVERNMENTAL AFFAIRS,
Washington, DC, July 21, 2006.

Hon. PETE V. DOMENICI,
Chairman, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

DEAR MR. CHAIRMAN: On May 16, 2006, Paul Golan, then Acting Director, Office of Civilian Radioactive Waste Management, testified regarding the Yucca Mountain Project.

Enclosed are the answers to 27 questions that were submitted by you and Senators Thomas, Craig, and Bingaman to complete the hearing record.

If we can be of further assistance, please have your staff contact our Congressional Hearing Coordinator, Lillian Owen, at (202) 586-2031.

Sincerely,

JILL L. SIGAL,
Assistant Secretary.

[Enclosures.]

RESPONSES OF THE DEPARTMENT OF ENERGY TO QUESTIONS
FROM SENATOR DOMENICI

Question 1a. In your testimony, you mention that the department is forming a task force to begin the process of looking for a second repository as required by the Nuclear Waste Policy Act.

When will this task force be formed?

Answer. The task force was established on May 19, 2006.

Question 1b. What is their criteria in selecting the second repository site?

Answer. The Nuclear Waste Policy Act (NWPA) directs the Secretary to evaluate the need for a second repository and report to the President and Congress between January 1, 2007 and January 1, 2010. The NWPA states that the Secretary may not conduct site-specific activities with respect to a second repository unless Congress has specifically authorized and appropriated funds for such activities.

Question 1c. What other factors will you take into consideration in preparing this report?

Answer. The specific factors that the Department of Energy will take into consideration in preparing the report are currently being developed. The focus of the task force will be on determining the need for a second repository. Some of the factors that will be considered include determining when the volume of spent nuclear fuel generated by commercial power plants will exceed the statutory limitation of 70,000 metric ton of heavy metal (MTHM) established by section 114 of the NWPA; assessing the reasonably expected disposal capability of Yucca Mountain considering current and projected future volume of spent nuclear fuel (SNF) inventories and its characteristics; and potential for waste minimization under advanced recycling technologies being evaluated in connection with the Global Nuclear Energy Partnership (GNEP).

Question 2a. Yucca Mountain currently has a legislated capacity limit of 70,000 metric tons.

Is this limit sufficient to accommodate spent fuel expected to be generated by the current fleet of reactors through their anticipated operations?

Answer. No, the 70,000 MTHM legislative limit will not accommodate all spent fuel expected to be generated by the current fleet of reactors through their anticipated operations.

Question 2b. How much spent fuel waste from government sources do you currently plan to emplace in the Yucca Mountain repository?

Answer. Approximately 2,333 MTHM.

Question 2c. What portion of the DOE inventory of spent nuclear fuel does this represent?

Answer. The estimated 2,333 MTHM represents over 95 per cent of the DOE inventory.

Question 2d. How many canisters of vitrified high-level nuclear waste does DOE expect to produce and how many canisters of that waste do you plan to emplace in the Yucca Mountain repository?

Answer. The Department expects to produce approximately 20,000 canisters of high-level radioactive waste (HLW). Estimates of HLW canister production at Idaho National Engineering Laboratory and Hanford may change, since facilities to immobilize HLW have not yet been constructed or operated. Under current plans for emplacement, the defense HLW allocation for Yucca Mountain is 4,667 MTHM or approximately 9,334 canisters, which represents about half of the defense HLW.

The fuel from our nuclear navy is destined to be disposed of at Yucca Mountain.

Question 3a. How much defense waste is currently planned for permanent disposition at Yucca Mountain?

Answer. Under current plans, approximately 7,000 MTHM of defense waste is to be emplaced at Yucca Mountain; 65 MTHM of the 7,000 MTHM would come from the Naval Nuclear Propulsion Program (NNPP), which represents the entire inventory of NNPP SNF.

Question 3b. Under current schedules, when will this waste be ready for shipment to Yucca?

Answer. Defense materials are anticipated to be available when repository operations begin and will be among the early materials provided to the repository.

Question 3c. If Yucca were not available, how would this waste be handled?

Answer. If Yucca Mountain were not available, DOE would continue to manage the storage of the waste at its current location in a safe and secure manner until a new path forward was selected.

Question 4. The federal government has a court settlement agreement with the state of Idaho regarding temporary storage of naval reactor spent fuel.

When must fuel be moved under this agreement?

Answer. Under the Agreement with Idaho, all SNF is required to be moved out of the State of Idaho by 2035.

Question 5. Six months prior to docketing a license application, DOE must have certified by NRC an internet based License Support Network of relevant documents. NRC denied certification of the draft LSN submitted in 2004.

What is the Department doing to address the deficiencies in the initial LSN and are you confident that these actions will result in a certifiable LSN?

Answer. The Department has evaluated the Pre-License Application Presiding Officer Board's order striking the Department's June 2004 certification. In response, the Department has reviewed approximately 4.8 million emails from inactive and external accounts to determine the relevance of each email. In 2004, there were approximately 1 million privileged documents included in the Licensing Support Network (LSN) database. All these documents have been reviewed, and the inventory of privileged documents has been reduced by more than 95%. The June 2004 certification included documents available up to February 2004. The Program has continued to collect relevant documents and add them to the DOE collection. The LSN project team has performed assessments to ensure the LSN will meet the Nuclear Regulatory Commission's (NRC) requirements and will continue to do assessments until the LSN is recertified.

Question 6a. In the past year, a decision was made to redirect the approach taken to fuel handling at the repository to a "clean" approach utilizing a single canister for transportation, aging and disposal (TAD).

What impact has this redirection had on preparing the license application?

Answer. The canistered approach to fuel handling at Yucca Mountain requires that portions of the license application (LA) and supporting information be revised to reflect this approach. The Department believes the benefits of the canistered approach justify the time needed for these revisions and will result in greater efficiency and timeliness on constructing and operating the repository.

Question 6b. What is the cost of TAD development?

Answer. The cost of adopting the transport, aging and disposal (TAD) approach to the repository system is still being evaluated.

Question 6c. Who will cover those costs?

Answer. The overall cost of procuring TADs for the repository system is expected to be paid from the Nuclear Waste Fund.

Question 7. How much have we spent on cask development (transport and storage) through the history of the program?

Answer. Since the Program began in 1983, we have been engaged in spent fuel storage and transportation cask development activities, including but not limited to costs expended in the 1980s and 1990s associated with siting and conducting assessments for a monitored retrievable storage facility and with studies on the interim storage of spent fuel. Concurrent with these activities, the Program also pursued the development of transportation and storage casks to support waste acceptance and handling operations at both storage facilities and the geologic repository. The De-

partment estimates that costs associated with these activities which occurred primarily in the 1980s and 1990s have been approximately \$287 million.

Question 8. Have you analyzed the impact that this redirection could have on the timing and cost of license review, program construction and operations?

Answer. The Department is currently analyzing the impacts. However, it believes the new approach will greatly contribute to the overall success and timeliness of licensing, constructing and operating the repository. In particular, this approach will both reduce the risks of repository worker radiation exposure during surface operations at the site and eliminate the need for large repository surface facilities required to handle individual spent fuel assemblies several times prior to packaging for disposal.

Question 9. Please describe the improvements to site infrastructure, the planning facilities for receipt of spent fuel and transportation infrastructure that you plan to accomplish with the FY 2007 budget request.

Answer. Over the next two years, and subject to appropriate National Environmental Policy Act (NEPA) review, the Department plans to undertake improvements to certain facilities, structures, roads, and utilities (collectively referred to as *infrastructure*) for the Yucca Mountain Project to enhance safety at the site and to continue conducting scientific activities, testing, and maintenance until such time as the Nuclear Regulatory Commission decides whether to authorize construction of a repository.

The Program's Site Plan identifies the upgrades to site systems and utilities that are planned for fiscal year (FY) 2006 to FY 2008. Site safety upgrades address code and safety compliance issues through the disposition of non-operational systems, structures and/or facilities; and the modification, upgrade, and/or replacement of potentially obsolete critical and operational systems and structures which are necessary to provide a safe and functional facility for continued support of experiments as well as site tours. These systems include power distribution, water supply, sanitation, fire protection, and communications.

In FY 2007, the Program anticipates that it will initiate procurements for transportation casks, and for the development of a prototype and testing of new rail rolling stock designs. Funding will also support awarding of contracts to start design of a security escort car prototype, review and comment on other new rail car preliminary designs, and preparation of test plans for the new designs.

Question 10. What additional steps are you taking to reaffirm confidence in the technical work done in support of repository performance? Have any of these reviews uncovered any information that would call into question the site suitability of Yucca Mountain?

Answer. The Department is taking aggressive steps to ensure the highest level of expertise and credibility, and to reaffirm confidence in the technical work in support of the repository performance as we move the Project forward. For example, in January 2006, the Department designated Sandia National Laboratories the lead laboratory to coordinate and organize all scientific work on the Project. The independent, expert review that the scientists at Sandia will perform will help ensure that the technical and scientific basis for the Yucca Mountain repository meets the requirements of 10 CFR 63 and NUREG 1804. Designating Sandia as the lead laboratory will provide the Program with centralized leadership for its science program and will increase technical credibility with the scientific community, as well as the Project's regulators and stakeholders.

In February 2006, the Department issued a technical report evaluating the infiltration estimates that were used in the site recommendation. The technical evaluation found that the infiltration results that had been completed are consistent with the conclusions of infiltration and recharge results from scientists independent of the Project, including the State of Nevada's Engineering Officer. This data fully supported the site suitability of Yucca Mountain. While we found that the science was sound, because some of our quality assurance (QA) requirements were not met, we are expending time and resources to replace the infiltration models and perform the analyses. We have directed Sandia National Laboratories to develop computer codes that will generate new infiltration rate estimates developed in accordance with our QA requirements, and will then replace the infiltration rate estimates for future analyses. The Sandia infiltration rates will be independently reviewed prior to incorporation into the Total System Performance Model.

To further ensure the highest quality and objectivity of the science and technology supporting the Yucca Mountain Project, in April 2006, the Department also selected the Oak Ridge Institute for Science and Education to perform independent review of key aspects of the Project. By bringing in Oak Ridge for independent reviews to assess our technical work, we will ensure a high level of expertise and credibility as the Project moves forward.

Question 11. Please summarize the transportation planning activities you are undertaking this year and what you plan to accomplish under the FY 2007 budget request.

Answer. In FY 2006, the Nevada Transportation Project anticipates it will complete the data collection and analyses necessary to support the pending environmental review pursuant to NEPA, and complete the rail security escort car conceptual design. The Department will continue to consult with States and Tribes as the transportation program is developed and plans to complete the Transportation Design Basis Threat and the Concept of Operations Document. In FY 2007, the Department anticipates further actions to complete its NEPA review and related activities. The Department also will issue the draft Section 180(c) policy and grant application process for comment.

Also in FY 2007, the National Transportation Project will establish the protocols needed to integrate, manage and safely operate the transportation system. The Project will continue the procurement process for casks and associated specialized equipment. The Department will also begin development of rail cars for transporting SNF and HLW. This hardware development will include a limited purchase of cask systems and prototype rail cars. These initial procurements will support emergency preparedness and security training efforts, as well as provide opportunities to test communications and tracking systems and establish relationships with transportation service providers.

The National Transportation Project will also continue to fund cooperative agreements with State regional groups and other key parties involved in transportation planning. Section 180(c) pilot grants will also be awarded to a few states and tribes in each region in order to support operational testing and to refine the Section 180(c) program. DOE will also work to integrate safety, security, and emergency response activities into all shipment plans.

Question 12. What is the status of developing the rail line in the state of Nevada?

Answer. Work in 2006 has focused mainly on completing the data gathering and engineering necessary to support the publishing of the Draft Rail Alignment environmental impact statement.

On May 4, 2006, the Department received a letter from the Walker River Paiute Tribe indicating they are now willing to permit the Department to evaluate the impacts of potential shipments of SNF and HLW across their Reservation. DOE is currently gathering data and information related to the feasibility of a route across the Tribe's Reservation, and is evaluating related programmatic, regulatory, and legal issues.

Question 13. Does the Department continue to support a mostly rail transportation strategy for the movement of civilian spent fuel?

Answer. Yes, the Department continues to support a mostly rail transportation strategy for the movement of civilian spent nuclear fuel.

RESPONSES OF THE DEPARTMENT OF ENERGY TO QUESTIONS FROM SENATOR THOMAS

Question 1. Because of an ongoing failure to meet contractual agreements with utilities and the expense of storing defense waste, each year this project is delayed adds over \$1 billion to the cost. When will we realistically be able to start shipping spent fuel to the Yucca Mountain repository?

Answer. The Nuclear Waste Policy Act provides for the Nuclear Regulatory Commission (NRC) to decide whether to issue a license that authorizes construction within 3 years of submission of the license application with the possibility of a 1 year extension. Construction of the initial facilities is expected to take 2 to 3 years. There are factors outside the control of the Department, however, that greatly influence when we will be able to begin receiving spent nuclear fuel (SNF) at Yucca Mountain. These include the issuance of the final Environmental Protection Agency radiation protection standards, funding levels, the NRC licensing process including issuance of a license amendment to receive and possess SNF and potential legislation.

Question 2. We have spent 20 years and \$8 billion on a scientific evaluation of Yucca Mountain as a suitable site for a nuclear waste repository. Will all that time and effort reduce the additional hurdles that exist for getting the site licensed?

Answer. The Department has engaged in over 20 years of scientific and technical investigation of the suitability of the Yucca Mountain site. As part of this investigation, some of the world's best scientists have been examining every aspect of the natural processes—past, present and future—that could affect the ability of Yucca Mountain to isolate radioactive waste. Additionally, there has been extensive work and investigation in the area of engineered barriers that are expected to contribute to successful radioactive waste isolation. The result is an extensive body of scientific

work that supports site selection and the Administration's site recommendation. The time and effort invested over the last 20 years will support the submittal of a high quality license application to the NRC.

Question 3. The Administration has developed the Global Nuclear Energy Partnership based largely on the idea that re-processing our spent fuel in an international and cooperative manner is beneficial. Will we eventually be able to remove the fuel that is stored at Yucca Mountain and re-process it?

Answer. While there are no plans to remove SNF from the repository, it is being designed to allow the retrieval of waste for up to 300 years after emplacement.

Question 4. If we opened Yucca Mountain tomorrow, how long would it take to ship and store all of the waste we have committed to dealing with already?

Answer. Under the current planned acceptance rates, the Department estimates that it would take 25 years to accept the 70,000 metric ton of heavy metal (MTHM) authorized for Yucca Mountain.

RESPONSES OF THE DEPARTMENT OF ENERGY TO QUESTIONS FROM SENATOR CRAIG

Question 1. Will the DOE have the infrastructure and applicable licenses (for shipping casks, rolling stock, etc.) in place in time to begin shipping spent fuel as soon as Yucca Mountain (or an interim storage site, if applicable) is open and ready to accept such waste? Could DOE begin shipping fuel quickly in the case of a national emergency?

Answer. The low level of funding has made it difficult to undertake planning, acquisition and construction in an orderly manner. The Department is proceeding with its transportation plans and expects to have transportation capability available when the repository opens.

Question 2. How will DOE prioritize spent fuel shipments to the repository once Yucca Mountain is open? More specifically, does DOE plan to begin shipping fuel out of Idaho as soon as the repository can begin accepting waste? Please explain how the various types of fuel will be prioritized for shipment out of Idaho, providing a breakdown according to fuel type (Navy, TMI, etc.). Where in the department's priorities does fuel from other sites fit?

Answer. DOE high-level radioactive materials are expected to be part of the initial shipments to Yucca Mountain, including the DOE spent nuclear fuel in Idaho. The currently planned schedule for shipping DOE waste is outlined in the Integrated Acceptance Schedule between the Office of Environment Management and the Office of Civilian Radioactive Waste Management. The commercial spent nuclear fuel acceptance priority is outlined in the Department's Acceptance Priority Ranking Report.

Question 3. I understand the department's decision to select Sandia National Laboratory as the lead lab to oversee the Yucca Mountain Project's science programs reflects, at least in part, Sandia's previous success with helping to open the Waste Isolation Pilot Plant (WIPP) in New Mexico, the world's first permanent geologic repository for transuranic waste. Mr. Golan: Can you please elaborate on the department's choice of Sandia Laboratory to fulfill this role?

Answer. Establishing Sandia National Laboratories as our lead laboratory is an important step in our new path forward. The experience that Sandia brings to the Project will help ensure that the technical and scientific basis for the Yucca Mountain repository meets the requirements of 10 CFR 63 and NUREG 1804. Sandia has unique experience in managing scientific investigations in support of a Federally licensed geologic disposal facility having served in that role to the Waste Isolation Pilot Plant (WIPP). Designating Sandia builds on DOE's successful experience at WIPP, where a single national laboratory coordinated "post-closure" science work while a contractor performed work on the design of "pre-closure," or above ground facilities. This move more clearly aligns responsibilities within the competencies of the Project's participants and will more effectively leverage the capabilities of Sandia's experience with repository science issues. Designating Sandia as the lead laboratory will provide the Program with centralized leadership for its science program and will increase technical credibility with the scientific community, as well as the Project's regulators and stakeholders.

Question 4. Please provide an estimate for when DOE plans to submit a license application to the NRC, and explain the reasons for continued delays.

Answer. The Department will publish its license application (LA) schedule this summer. The canistered approach to fuel handling at Yucca Mountain requires that portions of the LA and supporting information be revised to reflect this approach. The Department believes the benefits of the canistered approach justify the time needed for these revisions and will result in greater efficiency and timeliness on constructing and operating the repository.

Question 5. Please provide the current status of programs related to rail infrastructure and to truck infrastructure, including projected expenditures for the remainder of this fiscal year (FY2006).

Answer. None of the constrained FY 2006 funds have been invested in the development of truck infrastructure since the equipment needed to perform this work already exists. The commercial sector has the hardware and the manpower capacity to accommodate a large number of legal weight truck shipments of spent nuclear fuel. Although less extensive, the commercial capacity for “heavy haul” truck shipments also exists. It is expected that the DOE will negotiate contracts for these trucking services closer to the time shipments are scheduled and will rely on the private sector to provide the hardware assets.

Question 6a. Please provide a breakdown of projected expenditures for the Yucca Mountain program during this fiscal year (FY2006); that is, out of the approximately \$450M appropriated. Please specify expenditures for each of the following: Federal workforce.

Answer. \$79.2 M is projected in FY 2006 for the Federal workforce.

Question 6b. National Laboratories (break-down for each).

Answer. The break-down for national laboratories is as follows:

	FY 2006 (dollars in thousands)
Argonne National Laboratory	893
Idaho National Laboratory	9,534
Lawrence Berkeley National Laboratory	4,591
Lawrence Livermore National Laboratory	5,971
Los Alamos National Laboratory	7,547
Nevada Test Site	5,972
Sandia National Laboratories	16,058
Pacific Northwest National Laboratory	790
Total, Nuclear Waste Disposal and Defense Nuclear Waste Disposal Laboratory Funding	51,356

Question 6c. Federal-support contractors (again, for each major: notably, Bechtel-SAIC & Booz-Allen).

Answer. The break-down for Federal-support contractors is as follows:

Bechtel SAIC Company, LLC	235,356
Booz, Allen, & Hamilton, Inc. (OP)	4,839
Booz, Allen, & Hamilton, Inc. (PD)	20,888
CATAPULT (OP)	690
CATAPULT (PD)	10,372
Potomac-Hudson Engineering Inc.	7,000
ALPHA (PD)	1,210
BECHTEL NEVADA INC	924
AECL	415
AGEISS Environmental Inc.	1,242
LECHEL	450
WSI	1,418
KPMG, LLP	525

Question 6d. Private-sector contractors (i.e., exclusive of federal-support entities).

Answer. The Office of Civilian Radioactive Waste Management has no contracts that fit this description.

Question 7. What initiatives has the department undertaken to ensure meaningful participation by the private sector for developing the TAD canister, including new incentives and lessons-learned from the old MPC program? Please provide a schedule (with milestones) for completing the conceptual TAD design, as well as other important program steps (e.g. licensing & fabrication), please include critical TAD-system components (e.g. transport cask, transfer cask, ancillary equipment, disposal overpack).

Answer. The transport, aging and disposal (TAD) canister based system is an integral part of the Program's new approach. On April 26, the Department published in FedBizOps a Notice of Program Interest soliciting notice from qualified cask vendors of their interest in participating in the conceptual design of a TAD-based sys-

tem. The Department is in the process of evaluating the responses received. The Department believes that it is necessary to have participation from all qualified cask vendors in order for the TAD development effort to be successful.

To stimulate the timely development of TAD-based systems while relying upon the private sector to perform the detailed design and licensing required for TAD system deployment, the Department is considering utilizing a dual path approach to incentivize both the cask designer/manufacturer industry and nuclear utilities.

The Program is currently developing a timeline for TAD implementation and is evaluating appropriate measures to incentivize cask designer/manufacturer industry and utilities. The specifics are still under development.

RESPONSES OF THE DEPARTMENT OF ENERGY TO QUESTIONS
FROM SENATOR BINGAMAN

POTENTIAL LIABILITY TO UTILITIES FOR MITIGATION DAMAGES
OF THE STANDARD CONTRACTS

In April 2005, the United States Court of Federal Claims ordered the parties in *Sacramento Municipal Utility District v. United States* “to show cause why the court should not hold that the . . . Standard Contract . . . is void” and order the Government “to refund all monies paid to date by plaintiff into the Nuclear Waste Fund as restitution.” 68 Fed. Cl. 180,183 (2005). SMUD declined the court’s invitation to seek restitution, however, and, on March 31, 2006, ruled that SMUD was entitled to insist on the legal remedy of mitigation damages. Nonetheless, the court expressed its opinion “that restitution would be a much more efficient, fair, and final resolution of the Government’s breach” of the nuclear waste contracts.

It may make sense for the utilities to hold the Government to the Standard Contracts as long as there is hope that the Department will be able to open the Yucca Mountain repository and fulfill its contractual obligations to the utilities in the foreseeable future. It appears to make much less sense to continue “the status quo of litigating ad hoc damage claims and appeals” and “to issue rolling damage awards ad infinitum,” as the Court of Federal Claims said, if Congress abandons the nuclear waste management policy embodied in the Standard Contracts and embarks upon a new policy dependent upon a fuel “recycling” scheme that is dependent upon a new, yet-to-be-developed reprocessing technology and a fleet of new, yet-to-be-built fast reactors 25 or 30 years from now.

Question 1a. Please provide your best estimate of the Government’s potential liability to the utilities for mitigation damages for partial breach of the Standard Contracts in each of the following cases:

Yucca Mountain is licensed for the disposal of spent nuclear fuel and begins accepting spent fuel in 2015.

Answer. The Department’s best estimate of the Government’s potential liability to the utilities for mitigation damages for partial breach of the Standard Contract if Yucca Mountain is licensed for the disposal of spent nuclear fuel and begins accepting spent fuel in 2015 is approximately \$5 billion.

Question 1b. Yucca Mountain is licensed for the disposal of spent nuclear fuel and begins accepting spent fuel in 2020.

Answer. The Department’s best estimate of the Government’s potential liability to the utilities for mitigation damages for partial breach of the Standard Contract if Yucca Mountain is licensed for the disposal of spent nuclear fuel and begins accepting spent fuel in 2020 is approximately \$11 billion.

Question 1c. Yucca Mountain is licensed for the disposal of high-level radioactive waste from GNEP and the defense program and begins accepting those wastes in 2035.

Answer. Because this scenario provides no information regarding timing, i.e., when spent nuclear fuel would have left utility sites, nor is there information regarding rate, i.e., how much spent nuclear fuel is picked up at a time, there is not enough information to provide a meaningful response to this question.

REFUND AMOUNTS PAID BY UTILITIES INTO THE NUCLEAR WASTE FUND

Question 2. At what point is it in the best interest of the U.S. Treasury for the Government to ask the courts to void the Standard Contracts for mutual mistake, as the Court of Federal Claims has suggested and simply refund the amounts paid by the utilities into the Nuclear Waste Fund?

Answer. The Department and the Administration are firmly committed to moving forward with the Yucca Mountain project and do not believe it would be in the best interest of the U.S. Treasury or the Federal Government to void the Standard Contracts. As the Government argued in its response brief to the show cause order

issued by the court in the Sacramento Municipal Utility case, the Government has identified no basis to conclude that the Standard Contract is voidable based on the mutual mistake doctrine since mistake of fact cannot be a fact regarding a future event. Additionally, the Government has been unable to identify any mistaken belief of facts at the time of the Standard Contract's formation. Restitution is an improper remedy in this instance given that there is no basis to conclude the Standard Contract is void or is voidable.

Practically speaking, if DOE no longer can collect quarterly fee payments, there is no Nuclear Waste Fund to support the Department's spent nuclear fuel waste disposal program. One consequence of the program's failure to operate would be that the Nuclear Regulatory Commission (NRC) likely could be forced to revisit its waste confidence rule-making, jeopardizing the continuation of nuclear power in the country if there is no foreseeable plan to remove spent fuel from utility sites. Finally, even if the Standard Contract were deemed void, the Department would still have a statutory obligation to develop a Federal radioactive waste disposal program as directed by the Nuclear Waste Policy Act of 1982, as amended.

Question 3. You stated that the Department has hired the Oak Ridge Institute for Science and Education to provide an independent review of the project's scientific and technical work. Congress has already established the Nuclear Waste Technical Review Board to "evaluate the technical and scientific validity" of the project. How does the Oak Ridge Institute's role differ from that of the statutory Technical Review Board?

Answer. The Nuclear Waste Technical Review Board was established by Congress in the Nuclear Waste Policy Act as an independent establishment within the executive branch to evaluate the technical and scientific validity of activities undertaken by the Secretary and report to Congress and the Secretary its findings, conclusions, and recommendations.

The Oak Ridge Associated Universities/Oak Ridge Institute for Science and Education was contracted by, and reports to, the Office of Civilian Radioactive Waste Management (OCRWM) to provide independent expert reviews of specific scientific and technical issues and provides OCRWM access to a broad range of independent experts from around the country to evaluate and review our work products.

U.S. ENVIRONMENTAL PROTECTION AGENCY,
Washington, DC, June 8, 2006.

Hon. PETE V. DOMENICI,
Chairman, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

DEAR CHAIRMAN DOMENICI: Thank you for the opportunity to testify before the Senate Energy and Natural Resources Committee on the status of the Yucca Mountain project on May 16, 2006. Please find enclosed the Environmental Protection Agency's responses to the questions for the record I hope this information will be useful to you and the members of the Committee.

If you have any questions, please call me or your staff may call Ronna Landy, in the Office of Congressional Intergovernmental Relations, at (202) 564-3109.

Sincerely,

WILLIAM L. WEHRUM,
Acting Assistant Administrator.

[Enclosure.]

RESPONSES OF WILLIAM L. WEHRUM TO QUESTIONS FROM SENATOR DOMENICI

Question 1. In July 2004, the Court of Appeals for the District of Columbia Circuit found that the timeframe of EPA's standards were not consistent with the National Academy of Sciences' recommendations.

Answer. The Court ruled that EPA's policy justifications for the 10,000-year compliance period were not sufficiently consistent with or based upon the National Academy of Sciences (NAS) recommendation. Specifically, the Court stated that "The 10,000-year compliance period selected by EPA violates section 801 of the Energy Policy Act (EnPA) because it is not, as EnPA requires, 'based upon and consistent with the findings and recommendations of the National Academy of Sciences,'" *NEI v. EPA*, 373 F.3d 1 (D.C. Circuit 2004) at 4.

Question 2. What were the academies' recommendations?

Answer. NAS presented a number of recommendations on the form and content of the Yucca Mountain standards. Specifically, NAS recommended that the standards:

- Set a limit on the risk individuals of adverse health effects from releases from the repository;
- Measure compliance at the time of peak (maximum) risk, whenever it occurs;
- Evaluate the adverse effect of human intrusion into the repository;
- Set a limit for the assumed intrusion scenario that is no greater than the risk limit adopted for the undisturbed-repository case; and
- Use the critical-group approach to identify the individual for whom the risk calculation is to be made.

Regarding the regulatory compliance period, the NAS committee further stated that “there is no scientific basis for limiting the time period of the individual-risk standard to 10,000 years or any other value,” while also stating that the compliance period should be confined “within the limits imposed by the long-term stability of the geologic environment, which is on the order of one million years.”

The NAS committee recognized that, while its focus was on science and technical aspects, “the selection of a time period of applicability . . . also has policy aspects that we have not addressed.” For policy reasons, EPA led the compliance period to 10,000 years. EPA also required that DOE perform longer-term projections and place them in the EIS, but did not specify a compliance standard. The Court ruled that EPA’s policy justifications did not provide sufficient consistency with the NAS recommendation.

Question 3. Can you briefly walk the committee through how the EPA arrived at the 15 millirem standard for the first 10,000 years at Yucca Mountain?

Answer. The 15 millirem per year standard is consistent with the level established in EPA’s generally applicable standards for land disposal of spent nuclear fuel, high-level waste, and transuranic radioactive waste in 40 CFR part 191. As such, this level has been successfully used as the basis of EPA regulatory approval for a 10,000-year compliance period at the Waste Isolation Pilot Plant (WIPP). It is also consistent with EPA’s lifetime cancer risk range of 10^{-4} to 10^{-6} , which provides a risk and protectiveness context across EPA programs and pollutants. Further, 15 mrem/yr is within the range identified by NAS as an appropriate “starting point” for rulemaking, which is approximately 2 to 20 mrem/yr.

Question 4. And on the issue of predicting and setting standards on anything for one million years—how is this possible to do?

Answer. EPA has significant concerns regarding the use of mathematical calculations of projected performance over periods lasting hundreds of thousands of years as a basis for regulatory decision-making. EPA does not believe that such projections can be viewed with the same level of confidence as projections for even such relatively “short” times as 10,000 years. The uncertainties inherent in such projections led EPA to restrict the compliance period to 10,000 years in its 2001 standards, although projections were required beyond that point because they can still provide useful insights, even if they are not of sufficient quality to serve as a basis for regulatory decision-making.

EPA believes the approach recommended internationally, by the International Atomic Energy Agency (IAEA), among others, is appropriate. This approach places more emphasis on numerical projections for the initial period after closure, but gives more emphasis to other “qualitative” factors as the performance period increases. Qualitative factors that provide confidence in the robustness of the disposal system include such elements as engineering and design specifications, estimates of radionuclide movement through engineered and natural barriers, comparison with natural analogues (e.g., uranium ore bodies), radiotoxicity of waste remaining in the repository, extent of site characterization, and quality assurance programs.

Ten thousand years is commonly considered a period of significance, during which projections are generally considered more reliable for decision-making. EPA’s 2001 rule incorporated this approach by leaving the Nuclear Regulatory Commission (NRC) with discretion in evaluating the significance of the performance calculations. NRC was therefore not required to base its licensing decision on whether the projected peak dose satisfied a specific limit; rather, NRC could use the projections to inform its evaluation of other aspects of DOE’s license application that directly affect overall safety, such as assumptions regarding engineered barrier performance. NRC could assign the dose projections greater or lesser weight in the licensing decision, as it deemed appropriate.

EPA’s 2005 proposed rule, which was drafted to respond to the decision from the Court of Appeals for the District of Columbia Circuit, adds an additional standard to the 10,000-year standard to cover the period from 10,000 to 1 million years. However, EPA has proposed a higher long-term dose limit as a way of emphasizing other factors important to safety, such as those mentioned above, and recognizing the significant uncertainties in projections covering hundreds of thousands of years. EPA

chose to base this proposed higher limit on comparisons of natural background radiation rates within the United States. The range of variation in natural background radiation illustrates the levels of radiation exposure with which people live safely today and provides a reasonable benchmark or judging the overall safety of the Yucca Mountain disposal system over times approaching 1 million years. No other regulations have ever been contemplated for such regulatory timeframes.

RESPONSES OF WILLIAM L. WEHRUM TO QUESTIONS FROM SENATOR CRAIG

Question 1. How does EPA's revised standard compare with how other countries plan to regulate their spent fuel repositories?

Answer. EPA'S overall approach is generally consistent with the approach taken internationally, which views numeric dose projections as less reliable for regulatory decisionmaking at very long times. Guidance from the International Atomic Energy Agency (IAEA), among others, suggests that other "qualitative" factors should be given more emphasis in reaching a decision regarding the overall safety of a disposal system. Qualitative factors that provide confidence in the robustness of the disposal system include such elements as engineering and design specifications, estimates of radionuclide movement through engineered and natural barriers, comparison with natural analogues (e.g., uranium ore bodies), radiotoxicity of waste remaining in the repository, extent of site characterization and quality assurance programs.

While this view is widely accepted, individual countries have adopted different methods to implement. For example, France establishes a dose limit for the first 10,000 years that "will be applied for determining the acceptability of the radiological consequences." Beyond that point, however, the dose limit is a "reference value" that "may be supplemented, by more qualitative assessments of the results of these estimates." The Finnish standard requires dose assessments for "at least several thousands of years." In the longer term, the standard for compliance is based on radionuclide-specific release limits, with the stipulation that "at their maximum, the radiation impacts arising from disposal can be comparable to those arising from natural radioactive substances."

Both EPA'S 2001 rule and its proposed amendments incorporate this viewpoint. However, we believe the 2005 proposal is the only example that that would set a numerical standard for a compliance period of one million years.

Question 2. How meaningful is it to estimate potential radiation doses one million year into the future? And what is EPA perspective on the one million year timeframe?

Answer. EPA has significant concerns regarding the use of mathematical calculations of projected performance over periods lasting hundreds of thousands of years as a basis for regulatory decision-making. EPA does not believe that such projections can be viewed with the same level of confidence as projections for even such relatively "short" times as 10,000 years. The uncertainties inherent in such projections led EPA to restrict the compliance period to 10,000 years in its 2001 standards, although projections were required beyond that point because they can still provide useful insights, even if they are not of sufficient quality to serve as a basis for regulatory decision-making.

EPA believes the approach recommended internationally, by the International Atomic Energy Agency (IAEA), among others, is appropriate. This approach places more emphasis on numerical projections for the initial period after closure, but gives more emphasis to other "qualitative" factors as the performance period increases. Qualitative factors that provide confidence in the robustness of the disposal system include such elements as engineering and design specifications, estimates of radionuclide movement through engineered and natural barriers, comparison with natural analogues (e.g., uranium ore bodies), radiotoxicity of waste remaining in the repository, extent of site characterization, and quality assurance programs.

Ten thousand years is commonly considered a period of significance, during which projections are generally considered more reliable for decision-making. EPA's 2001 rule incorporated this approach by leaving the Nuclear Regulatory Commission (NRC) with discretion in evaluating the significance of the performance calculations. NRC was therefore not required to base its licensing decision on whether the projected peak dose satisfied a specific limit; rather, could use the projections to inform its evaluation of other aspects of DOE's license application that directly affect overall safety, such as assumptions regarding engineered barrier performance. NRC could assign the dose projections greater or lesser weight in the licensing decision, as it deemed appropriate.

EPA's 2005 proposed rule, which was drafted to respond to the decision from the Court of Appeals for the District of Columbia Circuit, adds an additional standard

to the 10,000-year standard to cover the period from 10,000 to 1 million years. However, EPA has proposed a higher long-term dose limit as a way of emphasizing other factors important to safety, such as those mentioned above, and recognizing the significant uncertainties in projections covering hundreds of thousands of years. EPA chose to base this proposed higher limit on comparisons of natural background radiation rates within the United States. The range of variation in natural background radiation illustrates the levels of radiation exposure with which people live safely today and provides a reasonable benchmark for judging the overall safety of the Yucca Mountain disposal system over times approaching 1 million years. No other U.S. regulations have ever been contemplated for such regulatory timeframes.

Question 3. What factors did EPA consider when revising its 2001 radiation standard?

Answer. The major factor that EPA considered was the main subject of the court remand—the compliance period. Other factors that were considered include: NAS findings and recommendations; the level of the peak dose limit (the additional standard applicable from 10,000 to 1 million years); the uncertainties involved in extremely long-term performance projections and how they can be addressed to make the standards implementable; international guidance and regulations; and implications for the human-intrusion and ground-water protection standards.

Question 4. When will the EPA issue its revised Radiation Protection Standard for Yucca Mountain?

Answer. EPA is making every effort to issue the final revised standards by the end of calendar year 2006.

RESPONSES OF WILLIAM L. WEHRUM TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. The U.S. Court of Appeals or the District of Columbia struck down EPA's original radiation protection standards for Yucca Mountain because they were not "based upon and consistent with" the findings and recommendations of the National Academy of Sciences, as required by the Energy Policy Act of 1992.

Answer. The Court ruled that the 10,000-year compliance period, combined with the requirement that longer-term projections be performed and placed in the Department of Energy's (DOE) Environmental Impact Statement (EIS), did not provide sufficient consistency with the NAS recommendation.

Question 2. The Academy's recommendation, as understood it, involved 2 variables. One was the time scale. The Academy recommended a million year time scale, and EPA's original standards adopted a 10,000-year period. That was the discrepancy the court focused on, and that is the discrepancy that your proposed rule would remedy.

Answer. Regarding the regulatory compliance period, the NAS committee recommended "that compliance with the standard be measured at the time of peak risk, whenever it occurs." The committee further stated that "there is no scientific basis for limiting the time period of the individual-risk standard to 10,000 years or any other value," while also stating that the compliance period should be confined "within the limits imposed by the long-term stability of the geologic environment, which is on the order of one million years."

The NAS committee recognized that, while its focus was on scientific and technical aspects, "the selection of a time period of applicability . . . also has policy aspects that we have not addressed." For policy reasons, EPA limited the compliance period to 10,000 years. EPA also required that DOE perform longer-term projections and place them in the EIS, but did not specify a compliance standard. The Court ruled that EPA's policy justifications did not provide sufficient consistency with the NAS recommendation.

Question 3. The other variable was the so-called exposure scenario. The Academy said that the chance that people would be exposed to radiation from the repository ought to be modeled on a statistical or "probabilistic" basis. EPA opted instead for a "deterministic" exposure scenario, based on a hypothetical "Reasonably Maximally Exposed Individual."

- Why did EPA reject the Academy's recommendation that it use a probabilistic scenario?
- Is EPA's deterministic scenario "based upon and consistent with" the probabilistic scenario recommended by the Academy if the Academy specifically considered and rejected EPA's deterministic approach when it prepared its report?

Answer. NAS recommended that EPA adopt a critical-group approach but recognized that such an approach could be implemented in many ways. The NAS committee offered the "probabilistic critical group" as one method that would meet the overall protectiveness goals while avoiding "unreasonable assumptions regarding

habits and sensitivities affecting risk.” Ultimately, however, NAS emphasized “that specification of exposure-scenario assumptions is a matter for policy decision.”

EPA selected the RMEI as both a simpler and more conservative alternative to the “probabilistic critical group” preferred by NAS. The RMEI is deterministic only in the sense that this hypothetical individual is always located above the point of highest contamination in ground water in the accessible environment and is assumed to drink 2 liters of ground water per day from that location. However, other exposure factors, such as diet, are representative of the current population and lifestyles in the Town of Amargosa Valley. In its comments on EPA’s 1999 proposal, NAS stated its belief that the RMEI was “broadly consistent” with the recommended critical group approach. The RMEI approach was not at issue in the 2004 Court of Appeals ruling, and EPA has not proposed to modify it.

Question 4. How do the radiation protection standards EPA is proposing for Yucca Mountain compare with those in effect for WIPP?

Answer. The level of protection for the first 10,000 years after disposal at both locations is 15 mrem/yr, and the ground-water protection standards for both are based on EPA’s drinking water standards. The differences in the two regulations stem primarily from the site-specific nature of the Yucca Mountain standards, as well as consideration of the NAS Report. These differences include the size of the controlled area (point of compliance), description of the RMEI (compared to “any member of the public” for WIPP), and the framing of the human intrusion standard. WIPP must also comply with radionuclide-specific release limits, which are not included in the Yucca Mountain standards. EPA has also proposed to update the method for calculating doses for the Yucca Mountain standards.

OFFICE OF THE GOVERNOR,
AGENCY FOR NUCLEAR PROJECTS,
Carson City, NV, June 13, 2006.

Hon. PETE V. DOMENICI,
Chairman, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

DEAR SENATOR DOMENICI: Enclosed please find responses to the questions that both you and Senator Craig provided following your hearing on the status of the Yucca Mountain project. Should you have additional questions, please do not hesitate to contact me.

Sincerely,

ROBERT R. LOUX,
Executive Director.

[Enclosure.]

RESPONSES OF ROBERT LOUX TO QUESTIONS FROM SENATOR DOMENICI

Question 1. DOE recently released an independent study which was reviewed by the Colorado School of Mines, the University of Arizona, and the U.S. Dept of Agriculture regarding the water infiltration work conducted by the United States Geological Survey that was the subject of the questionable e-mails. This report confirmed that the data in question was correct. Do you dispute this conclusion? If so, on what basis?

Answer. The report referenced in this question is: Evaluation of Technical Impact on the Yucca Mountain Project Technical Basis Resulting From Issues Raised by E-Mails of Former Project Participants, Office of Civilian Radioactive Waste Management, DOE/RW-0583, February, 2006. The report does not confirm that the data in question was correct. The following are the conclusions of the report (page 24):

“From this evaluation, the following conclusions can be drawn:

1. The net infiltration rate estimates for Yucca Mountain are developed from, a strong conceptual and hydrologic basis, including regional and site investigations dating back to the 1970s. The concepts, principles, and methods applied at Yucca Mountain are consistent with standard scientific practice as documented in the scientific literature.
2. Corroborating data on long-term net infiltration and groundwater recharge are publicly available in the scientific and technical literature. These data, surveyed for Nevada and the Western United States, are consistent with current estimates of net infiltration for Yucca Mountain, both under the modern climate and for potential future climate scenarios.
3. Data plots demonstrate that the net infiltration rate estimates for Yucca Mountain provide reasonable inputs to unsaturated zone flow mod-

eling and the total system performance assessment modeling for the Site Recommendation. Figure 4-5 presents a compilation of all data discussed in this evaluation, showing that the Yucca Mountain net infiltration rate estimates are within the ranges of these data.

4. The net infiltration rate estimates and the conceptual models from which they were developed were published in peer-reviewed scientific journals and were the subject of an expert elicitation.

5. Net infiltration at Yucca Mountain is a small fraction of average annual precipitation, representing between about 1 percent and about 6 percent, meaning that, on average, between 1 and 10 mm/yr infiltrates into Yucca Mountain."

Based on our review of the report, we generally agree with and do not dispute these conclusions. But, additional future analysis may result in revision of the average annual net infiltration into Yucca Mountain stated in Conclusion 5 above.

Question 2. You have indicated that an aging facility or "fuel cooling facility" would be the same thing as interim storage. However, if such a facility were simply an operational component of a repository licensed for permanent disposal, wouldn't this be something very different from interim storage?

Answer. Fuel cooling is not integral to the operation of a repository licensed for permanent disposal. Fuel cooling begins with the removal of irradiated fuel from an operating reactor, and continues throughout the decay period of the radionuclides contained in the fuel. Thermal limits for a particular repository geologic setting and design may require control of the thermal impact of the irradiated fuel within the repository, but this can be accomplished in various ways, none of which require "aging" the fuel at the repository site. For example, adjusting the areal mass loading of the fuel to meet repository thermal limits would eliminate the need for "aging" the fuel, thus eliminating the need for any aging facility prior to emplacement in the repository.

The "aging facility" as conceived for a Yucca Mountain repository is interim storage of commercial spent nuclear fuel interim between removal from the reactor site and emplacement in the repository. If the purpose of the facility was to optimize repository loading operations, a relatively small lag storage facility could be planned, instead of a facility intended to store from 21,000 to 40,000 metric tonnes of heavy metal for an indefinite period of time.

The NRC is withholding judgment on whether the "aging facility" would need to be licensed as an Independent Spent Fuel Storage Installation, under 10 CFR Part 72, rather than as part of the repository, pursuant to 10 CFR Part 63. The issue, according to NRC, is whether DOE can demonstrate that the facility is integral to the repository operation in its License Application. By calling it an "aging facility" DOE has defined its purpose, which is distinctly separate from the operation of the repository, and will be accomplished any place the fuel resides, and in whatever amount is stored at any location.

Question 3. You have indicated that without metal waste containers, peak radiation doses would exceed the EPA 15 millirem limit within 500 years. Can you please describe the basis for this conclusion?

The source document for this information is: FY01 Supplemental Science and Performance Analyses, Volume 2: Performance Analyses, July 2001, Bechtel SAIL Company, LLC, TDR-MGR-PA-000001 REV 00. Figure 3.2.2-9, Annual Dose Histories with and without Seepage during the Boiling Period for the Case with Neutralized Waste Package and Drip Shields, shows the mean annual dose curve intersecting the 15 millirem per year dose level at approximately 500 years. The same figure indicates the mean peak dose, at about 600 millirems per year, occurs at approximately 2,000 years.

RESPONSES OF ROBERT LOUX TO QUESTIONS FROM SENATOR CRAIG

Question 1. Does Nevada support GNEP? Would Nevada seek to participate in GNEP if hosting an interim storage site is a required part of that?

Answer. Nevada does not support GNEP and does not seek to participate in any way.

Question 2. Given that nuclear waste must eventually be dealt with in a safe and responsible manner, even with GNEP, do you see[n] any practical alternative to eventual permanent geologic disposal of nuclear spent fuel, as endorsed by the National Research Council?

Answer. At this time, Nevada does not know of any technical reason to reject the concept of deep geologic disposal of high-level radioactive waste, whether the waste form is spent nuclear fuel or some other configuration. Of course, implementation of the concept requires a suite of rigorous pre-established siting, licensing, and safe-

ty standards that assure the ability to disqualify a proposed repository at any time prior to closure.

Question 3. From your experience with these issues, could you name any sites in the U.S. that you feel should be investigated as a potential repository location[s] that are better suited than Yucca Mountain?

Answer. For reasons stated in Governor Guinn's Notice of Disapproval of the Yucca Mountain Site Recommendation, submitted to the Congress in 2002, Yucca Mountain is not technically acceptable as a permanent repository location. Sufficient information does not exist to suggest any specific sites in the U.S. that should be investigated, especially under the current regulatory and policy regime that is driven by mission zealots who show little regard for the safety of affected citizens. It also should be noted that the Congressional prohibition of investigation of granite sites in the 1987 Nuclear Waste Policy Act Amendments is scientifically unsupportable and a policy travesty.

Question 4. If the scientific & technical community can demonstrate the safety of Yucca Mountain, and the regulatory authority accepts it, is there any reason why the country should not go forward with Yucca Mountain?

Answer. With the current state of regulations and safety standards for a Yucca Mountain repository, there is no basis for demonstration of the safety of the site. What has been demonstrated is the opposite—that the site does not meet even a minimal expectation for geologic isolation of radioactive wastes. See our response above to Question 3 from Senator Domenici. If the original DOE Site Recommendation Guidelines and process, NRC licensing regulations, and EPA safety standards were applicable, the Yucca Mountain site would have been disqualified for technical reasons, as recommended by Nevada Governors to Secretaries of Energy, first in 1989 and again in 1999.

Question 5. Do you have reason to believe that the NRC is not capable of granting a license and regulating Yucca Mountain competently and fairly and with the health and safety of Nevadans being of paramount importance?

Answer. We have reason to believe that the NRC staff has been diligent in its effort to convince DOE that its Yucca Mountain License Application, if submitted, must be complete and of high quality. We also have reason to believe that, if a license application is submitted, the NRC review and hearing process is capable of denial of a license, which it should do, and Nevada will make every effort to secure such a result.

APPENDIX II

Additional Material Submitted for the Record

STATEMENT OF ADMIRAL FRANK L. "SKIP" BOWMAN, U.S. NAVY (RETIRED), PRESIDENT
AND CHIEF EXECUTIVE OFFICER, NUCLEAR ENERGY INSTITUTE

Mr. Chairman and members of the committee, I am Frank L. "Skip" Bowman, president and chief executive officer, at the Nuclear Energy Institute (NEI). Thank you for this opportunity to share the nuclear energy industry's assessment of the Department of Energy's civilian radioactive waste management policies and of the Yucca Mountain project. Having served 38 years in our United States Navy, I am convinced that our country's national security is inextricably linked to our energy security, and that nuclear energy must be a large part of that energy security.

NEI is responsible for developing policy for the commercial nuclear industry. NEI's 250 members represent a broad spectrum of interests, including every U.S. electric company that operates a nuclear power plant. NEI's membership also includes nuclear fuel cycle companies, suppliers, engineering and consulting firms, national research laboratories, manufacturers of radiopharmaceuticals, universities, labor unions and law firms.

SUMMARY

In keeping with the scope of this hearing, I will focus my testimony on the following key issues:

- DOE must make visible and measurable progress in implementing an integrated national used nuclear fuel management strategy, which has as an integral component the Yucca Mountain, Nev., repository. This progress will help ensure that the expanded use of nuclear energy will play a key role in our nation's strategy for meeting growing electricity demand.
- The industry's evaluation of DOE's civilian used nuclear fuel program's actions to address challenges so that the federal government meets its statutory and contractual obligations to remove used nuclear fuel from utility sites and dispose of it in a timely manner.

The industry believes that the provisions of the Nuclear Fuel Management and Disposal Act, S. 2589, provide a solid basis for making the necessary progress towards addressing the challenges. We urge the Committee to hold a subsequent hearing on the details of this legislation as soon as possible and report to the Senate its legislative recommendations to move forward on implementing our national policy during this session of Congress.

NUCLEAR ENERGY MUST PLAY A KEY ROLE IN OUR ENERGY FUTURE

In the 2005 State of the Union address, President Bush affirmed the nation's commitment to "safe, clean nuclear energy" as part of a diverse portfolio that will meet America's future electricity needs. A long-term commitment to nuclear energy will make the United States more energy independent and energy efficient. The Administration and Congress demonstrated strong leadership by enacting the Energy Policy Act of 2005, which encourages diversity of energy sources, including emission-free sources of electricity, such as nuclear energy.

The nation must focus on clean, reliable and affordable energy sources, such as nuclear, that are available today. Nuclear energy offers several unique advantages. It is the only expandable baseload energy source that does not emit carbon or other greenhouse gases into the atmosphere. Nuclear energy safely and reliably provides price stability for electricity customers as the prices for fossil fuels fluctuate. It also provides exciting new opportunities in areas such as hydrogen production. Although our nation must continue, to employ a mix of fuel sources for generating electricity,

we believe it is important that nuclear energy maintain at least the current 20 percent contribution to U.S. electricity production. Maintaining that level of production will require construction of a significant number of new nuclear plants beginning in the next decade.

There is strong, bipartisan support for a continuing significant role for nuclear power. More than two thirds of the public supports keeping nuclear energy as a key component of our energy portfolio. Many in the environmental community recognize the key role that nuclear energy can play in controlling greenhouse gas emissions. The industry appreciates the recognition of the nuclear energy's importance that Congress and the Administration demonstrated in the last year's comprehensive Energy Policy Act of 2005.

Recently, a new coalition of diverse organizations and individuals has been formed to educate the public on nuclear energy and participate in policy discussions on U.S. energy issues. The Clean and Safe Energy coalition, co-chaired by Greenpeace co-founder Patrick Moore and former Environmental Protection Agency Administrator Christine Todd Whitman includes business, environmental, labor, health and community leaders among its 120 members.

PROGRESS ON USED FUEL MANAGEMENT MUST MOVE HAND-IN-HAND WITH INDUSTRY DEVELOPMENT

The provisions of the Energy Policy Act of 2005 clearly stimulated interest among electric utilities in constructing new nuclear plants. This increased interest requires progress on the federal government's used fuel management policies; The federal government must meet its contractual responsibility to accept, transport and dispose of used nuclear fuel through a comprehensive radioactive waste management program including continued progress toward a federal used nuclear fuel repository.

While it is important to recognize that the industry and other key stakeholders are not satisfied with the extent of progress made by the federal government in meeting the requirements of the NWPA as amended, progress has been made.

- There is long-standing international scientific consensus that a deep geologic repository is the best solution for long-term disposition of commercial used nuclear fuel and high-level radioactive byproducts of our nation's defense programs.
- The Bush Administration and Congress affirmed the scientific suitability of Yucca Mountain for a repository in 2002 after nearly 20 years of scientific study. Over the past three years, DOE and its contractors have provided further confirmation that Yucca Mountain is an appropriate site for a national repository. Federal courts have rejected significant legal challenges by Nevada and others to the Nuclear Waste Policy Act and the 2002 Yucca Mountain site suitability determination. A federal court also affirmed that the Yucca Mountain Development Act is constitutional and DOE's repository system design, which incorporates both natural and engineered barriers to contain radioactive material safely, is consistent with the law.
- Suggestions that DOE postpone Yucca Mountain indefinitely and leave used fuel at reactor sites for a century or more while waiting for some "magic bullet" solution ignores the significant safety and security advantages of centralized storage at a federal facility and the monumental additional costs that taxpayers would ultimately bear waiting for this "solution." Even if such a solution were found, there is still a near-term need for the repository to provide disposal of high-level radioactive waste from defense programs.
- The industry believes that DOE has the authority to take advantage of significant opportunities to advance its comprehensive used fuel management program and the Yucca Mountain project in particular. The industry also believes that S. 2589 best addresses many of the issues limiting progress at Yucca Mountain.

PROGRESS TOWARD LICENSING YUCCA MOUNTAIN MUST CONTINUE

The industry, is encouraged by the leadership and management provided to the program by Energy Secretary Samuel Bodman, Deputy Secretary Clay Sell and Acting Director of the Office of Civilian Radioactive Waste Management, Paul Golan.

They are leading the transition from a purely scientific program, focused on site characterization and site approval at Yucca Mountain, to one that is preparing to enter a rigorous Nuclear Regulatory Commission licensing process. This progress has continued as the department addresses challenges, such as the revised Environmental Protection Agency radiation protection standard. DOE has made significant progress toward resolving key technical issues with the NRC before it submits a license application for Yucca Mountain. DOE is also adopting industry best practices

to ensure that it will submit a quality application to the NRC. It plans to include in this application a revised surface facility design that will handle fuel in standardized multipurpose canisters. Using transportation, aging and disposal (TAD) canisters in combination with associated surface facilities will reduce the need to handle used fuel at Yucca Mountain and increase safety. It is important that DOE complete these efforts, file a high quality repository license application in a timely manner and, ultimately, complete the transition to a design, engineering and construction project.

The recently announced design changes involving use of standardized containers can assist the industry in meeting important goals for management of used fuel at a geologic repository with the potential to retrieve it if that becomes desirable. The industry is appropriately engaged with DOE to ensure that these standardized canisters can be loaded and transported from our facilities safely and efficiently. In addition, the industry is committed to helping DOE address technical issues at Yucca Mountain in the same effective, high quality manner that has become the expected norm at the Nation's 103 reactors. The industry is encouraged by DOE'S recent progress towards the alignment of a rail spur to Yucca Mountain. The development of necessary transportation infrastructure and planning should continue to be a high priority.

As part of this committee's ongoing review of the DOE repository program, the industry urges Congress to exercise careful oversight of the licensing process, starting with the quality and timeliness of the filing of the license application by DOE. This can ensure that the program is not further delayed. This Committee should challenge DOE to show how it will incorporate the proposed design changes into the license application in a manner that will allow for its submission in a timely fashion. DOE should provide Congress detailed program milestones, a revised five-year funding profile for the program, and an updated life-cycle cost estimate for the repository, in conjunction with the updated program schedule that DOE officials have promised this summer.

Legislative deliberations should not preclude DOE from filing a license application. The NRC should begin reviewing the repository license application, when it is submitted with the knowledge that DOE can amend it to address changes, if any, resulting from new legislation.

THE YUCCA MOUNTAIN LICENSING PROCESS PROVIDES FLEXIBILITY TO ADDRESS FUTURE DEVELOPMENTS

DOE should incorporate, as provided by existing regulations, features into its repository development plans that maintain flexibility for future generations to make informed decisions, based on operational experience, changing energy economics, and technological developments.

The nuclear energy industry supports enhancements to the Yucca Mountain repository that would provide greater long-term assurance of safety and permit DOE to apply innovative technology at the repository as it is developed. These enhancements include:

- extensive monitoring of the used nuclear fuel placed in the repository and its effects on the surrounding geology for 300 or more years
- the ability to retrieve the used nuclear fuel from the facility for an extended period
- periodic review of updates to the repository license that takes into account monitoring results and ensures that the facility is operating properly.

DOE already has committed to facilitate the use of these elements in its repository planning. For a period of 50 to 300 years, the federal government will "collect, evaluate and report on data" to assess the performance of the repository and the ability to retrieve the used fuel within the facility, if desired. In addition to monitoring material within the facility, DOE will conduct tests and analyses to ensure that the repository is constructed and operated according to strict guidelines. Although DOE is pursuing these elements, the proposed enhancements would provide greater scientific and regulatory oversight of long-term repository operation and the condition of the material stored there. Doing so would require no modification of the existing federal statutory or regulatory framework.

The Energy Department could include these enhancements as part of its license application and the commitment to complete them should be incorporated as a condition of the NRC license.

These recommendations offer greater assurance to the public that long-term stewardship of used fuel at Yucca Mountain will be carefully monitored throughout repository operation. They also would allow DOE to take advantage of future techno-

logical innovations to improve the repository or provide for the potential reuse of the energy that remains in the fuel.

CHALLENGES REMAIN FOR MEETING FEDERAL OBLIGATIONS

DOE must address a number of issues to provide stability, clarity and predictability of our national used nuclear fuel policy. Conditions must be in place to facilitate near-term movement of used fuel, assurance of transportation safety and security, licensing and construction of the repository, and permanent disposal of used fuel in the repository. The following are the industry's priorities for meeting the federal obligation.

DOE Should Move Used Nuclear Fuel From Reactor Sites

The industry's top priority is for the federal government to meet its statutory and contractual obligation to move used fuel away from operating and decommissioned reactor sites. The government already is eight years in arrears in meeting this obligation, and it will be at least another decade before the repository is completed. That failure is the subject of more than 60 lawsuits. Three of these suits, representing only a fraction of the reactor sites, have resulted in settlements or judgments totaling \$340 million for costs incurred.

Further, delays in federal receipt and movement of used nuclear fuel and defense waste products could cost taxpayers over \$1 billion per year in defense waste site life-cycle costs, operating costs at utilities and Yucca Mountain fixed costs, exclusive of litigation damages already incurred, according to DOE.

While DOE moves forward to license, construct and operate the Yucca Mountain repository, the government must take title to used fuel and move it to a secure federal facility as soon as practicable. The industry recognizes that there are different interpretations as to the department's authority to undertake such an action. Therefore, Congress should work with DOE to take steps that will facilitate the movement of used fuel from utility sites.

Waste Confidence Should Be Affirmed

The nation's policymakers must be confident that policies are in place to ensure the safe and secure storage and disposal of used nuclear fuel. This waste confidence determination is reflected in Nuclear Regulatory Commission rules that support various licensing actions. However, such an approach creates uncertainty, because NRC regulations and licensing decisions are subject to litigation.

Managing the nation's used fuel is a firmly established federal obligation and, as such, is a matter of broad national policy. There is solid scientific and technical justification to affirm waste confidence. In 2001, the National Academy of Sciences confirmed four decades of international scientific consensus that geologic disposal is the best method for managing used nuclear fuel. Congress approved a geologic disposal site at Yucca Mountain in 2002.

In the Energy Policy Act, Congress included provisions that encourage the construction of new nuclear power plants, illustrating confidence in the nation's ability to manage used reactor fuel in the future. In addition, the Energy Department has safely operated a geologic disposal site for transuranic radioactive waste near Carlsbad, N.M., and 34 temporary dry-cask storage facilities for used nuclear fuel have been licensed at nuclear power plants. The first such facility has been operating since 1986. Congress should codify "waste confidence" so that the NRC need not address this broad public policy matter as a routine regulatory matter.

Funding Predictability Should Be Established

Congress established the Nuclear Waste Fund to cover costs associated with disposal of commercial used nuclear fuel. This fund is paid for by a one-tenth-of-a-cent-per-kilowatt-hour fee on electricity used by consumers of nuclear energy. Initially, expenditures from the fund were not scored in the budget as part of the discretionary spending totals. This was similar to budget treatment of other user fees, including those for the NRC. More than a decade ago, Congress deviated from this principle and forced Nuclear Waste Fund expenditures for Yucca Mountain to compete in the federal budget with unrelated programs, despite this dedicated source of revenue.

As a result, Yucca Mountain budget requests have been cut by more than \$1 billion over the last decade. Program funding requirements are forecast to increase substantially over the next few years. If overall spending totals remain flat, even more significant delays could result not because nuclear power consumers have not provided the funds necessary to support the program, but because of inappropriate federal budget accounting.

To date, consumers of nuclear power have committed more than \$27 billion in fees and accrued interest into the fund, and continue to pay at a rate of \$750. million each year. However, only some \$9 billion has been spent on the project, leaving a balance in excess of \$18-billion. In recent years, fee income has been five times as high as annual spending from the fund.

Artificial Constraints on Repository Operations Should Be Eliminated

Currently, there is a statutory limit of 70,000 metric tons on the amount of nuclear waste materials that can be accepted at Yucca Mountain. The Environmental Impact Statement for the project analyzed emplacement of up to 120,000 metric tons of nuclear waste products in the repository. Additional scientific analyses suggest significantly higher capacity could be achieved with changes in the repository configuration that use only geology that has already been characterized and do not deviate from existing design parameters.

Decisions on licensing and operations of a deep geologic repository at Yucca Mountain should be based on scientific and engineering considerations through the NRC licensing process, not on artificial constraints. Given the decades of study and the billions of dollars invested in Yucca Mountain, it makes sense that we fully and safely utilize its potential capacity.

Clarity and Stability in the Licensing Process Should Be Provided

The NRC repository licensing process should be restructured to ensure that the proceedings are prioritized. First, there must be a reasonable, but finite, schedule for review of the authority to “receive and possess” fuel that would follow approval of the construction license. This would be consistent with an established schedule for the initial review of the construction license application and could avoid dilatory procedural challenges that would undermine the government’s ability to meet its contractual obligations and avoid the significant costs of delay.

Second, clarification must be provided as to what activities are authorized to develop used fuel management infrastructure prior to the NRC granting a construction license, including the construction of a rail line to connect the Yucca Mountain site with the national rail network.

Third, the hearing process for the authorization to receive and possess fuel should be simplified to provide for clear and concise decision making.

Finally, clarification is needed with respect to land management, what regulations will apply to repository construction and operations, and which agencies will administer those regulations.

ADDITIONAL FACTORS FOR CONSIDERATION

Used Nuclear Fuel Recycling

The nuclear energy industry has shown consistent and strong support for research and development of advanced fuel cycle technologies incorporated in the Advanced Fuel Cycle Initiative (AFCI). In anticipation of a major expansion of nuclear power in the United States and globally, it is appropriate to accelerate activities in this program. The resurgence in development of nuclear energy is expected to require advanced fuel cycles. However, a repository will be necessary to handle defense wastes, legacy commercial used nuclear fuel and by-products regardless of whatever fuel cycle is ultimately developed.

President Bush has presented a compelling vision for a global nuclear renaissance through the Global Nuclear Energy Partnership (GNEP). This initiative provides an important framework to satisfy U.S. and world needs for an abundant source of clean, safe nuclear energy while addressing challenges for related to fuel supply, long-term radioactive waste management and proliferation concerns.

We recognize that the Congress has important questions regarding this program. The near-term focus for GNEP is for DOE to determine, by 2008, how to proceed with demonstration of advanced recycling technologies and other technological challenges. Consequently, the industry fully supports increased funding for AFCI in fiscal 2007. However, neither AFCI nor GNEP, reduces the near-term imperative of developing the Yucca Mountain repository.

A Constructive Role for Nevadans

The nuclear energy industry supports an active and constructive role for Nevada in the development of Yucca Mountain to help ensure the safety of its citizens. The industry also supports compensation for the state to account for the program’s socioeconomic impact, as called for in the Nuclear Waste Policy Act. This model is consistent with the siting and operation of the Waste Isolation Pilot Project.

The industry is encouraged that Nevadans at the local level share a common goal with DOE, the NRC and industry to ensure safe development of Yucca Mountain

and the related transportation infrastructure. One recent example of this activity is a cooperative agreement initiated in 2004 among three impacted counties, the city of Caliente and DOE. Another example is the coalition of Nevada business, labor and community leaders that formed "For a Better Nevada to promote the interests of Nevadans with respect to the Yucca Mountain project. The coalition has particularly identified its interest in incorporating enhanced monitoring and retrievability into the repository program.

The work of this coalition is particularly important in view of Nevada public opinion. Most Nevadans believe that the facility will ultimately be built and that the governor and U.S. Senators of Nevada should negotiate with the federal government so that the state can receive millions of dollars in special annual payments to reduce taxes, help expand the economic diversity of Nevada, improve education, and for highway improvement, if the Yucca Mountain project is approved for a disposal facility.

The industry is encouraged by the steps DOE has taken to work with affected local governments in the state, and we further encourage the department to expand its interactions with Nevadans interested in being constructively engaged in the project.

CONCLUSION

We must never lose sight of the federal government's responsibility for civilian used nuclear fuel disposal, as stated by Congress in the Atomic Energy Act of 1954 and the Nuclear Waste Policy Act of 1982. The industry fully supports the fundamental need for a repository so used nuclear fuel and the byproducts of the nation's nuclear weapons program are safely and securely managed in a specially designed, underground facility. World-class science has demonstrated that Yucca Mountain is the best site for such a facility. A public works project of this magnitude—the largest ever of its kind will inevitably face setbacks. Yet, none is insurmountable. DOE and its contractors have made significant progress on the project and will continue to do so as the department prepares to submit a license application to the NRC. However, DOE is eight years late in meeting its commitment to begin accepting reactor fuel and must proceed without further delay with an integrated used fuel management strategy.

A viable used fuel management strategy is necessary to retain long-term public confidence in operating existing nuclear power plants and build new facilities. The public confidence necessary to support construction of new nuclear plants is linked to successful implementation of an integrated national used fuel policy, which includes a continued commitment for the long-term disposition of used nuclear fuel. This requires a commitment from the Administration, Congress and other stakeholders to ensure that DOE makes an effective transition from a scientific program to a licensing and construction program, with the same commitment to safety. New waste management approaches, including interim storage and nuclear fuel recycling, are consistent with timely development of Yucca Mountain.

The challenge before the Administration and Congress is to implement our national policy for used fuel management, which includes resolving the near-term difficulties facing Yucca Mountain and setting the project on a path to success. The nuclear energy industry urges this Committee to continue to work with the Administration, the citizens of Nevada, the industry and other stakeholders as DOE continues its important work to develop a safe, secure repository for used nuclear fuel at Yucca Mountain. It is our responsibility to America today and to future generations, to ensure timely successful completion of Yucca Mountain.

STATEMENT OF LEROY KOPPENDRAYER, CHAIRMAN, MINNESOTA PUBLIC UTILITIES COMMISSION, AND CHAIRMAN, NUCLEAR WASTE STRATEGY COALITION

Mr. Chairman, and distinguished members of the Committee, the Nuclear Waste Strategy Coalition (NWSC) appreciates this opportunity to present a Statement for the Record regarding a hearing on the status of the Yucca Mountain Repository Project within the Office of Civilian Radioactive Waste Management, the Department of Energy (DOE).

ABOUT THE NWSC

The Nuclear Waste Strategy Coalition (NWSC) is an ad hoc group of state utility regulators, state attorneys general, electric utilities and associate members representing 46 member organizations in 26 states. The NWSC was formed in 1993 out of frustration at the lack of progress DOE had made in developing a permanent re-

pository for spent nuclear fuel (SNF) and high-level radioactive waste (HLRW), as well as Congress's failure to sufficiently fund the nuclear waste disposal program (Program). The mission and purpose of the NWSC is to seek on behalf of the ratepayers of the United States:

- 1) The removal of commercial spent nuclear fuel from more than 73 temporary commercial storage sites located in 33 states.
- 2) The authorization of a temporary, centralized commercial spent nuclear fuel storage facility.
- 3) The allocation of appropriate funds from the Nuclear Waste Fund (NWF) by the U.S. Congress to the DOE so that it will fulfill its statutory and contractual obligations.
- 4) The augmentation of transportation planning and regulations to facilitate transportation systems.
- 5) The capping of the NWF payments at the present one-tenth of a cent per kilowatt-hour by the U.S. Congress.
- 6) The operation of the permanent repository as soon as possible.

NUCLEAR WASTE FUND REFORM

NWSC members believe it is vitally important that Congress and the Administration work together to ensure the Program is funded in a manner that will allow the DOE to implement the Federal Program in accordance with the 1982 Nuclear Waste Policy Act, amended (NWP). The Program is already in default of its requirement to open a facility by 1998, and is slipping further behind schedule. It is imperative that a long-term fix of the current funding process be implemented and we urge Congress to support legislation that reclassifies the fees paid into the NWF as offsetting collections in the 109th Congress.

The NWSC is not calling for carte blanche funds for the DOE without Program oversight. Over the years, the NWSC has been very supportive of the OCRWM program and worked to ensure that Congress appropriate sufficient funds for the nuclear waste transportation and disposal program. We continue those efforts today as we are working very hard for passage of comprehensive legislation that reforms the NWP. Congress has an opportunity to fast track comprehensive legislation in the 109th Congressional session to enhance the management and disposal of SNF and HLRW, ensure protection of public health and safety and territorial integrity and security of the permanent repository. Moreover, reforming the annual funding for the Program, assures the 41 states ratepayers that their payments into the NWF are being used for their intended purpose—the removal of SNF and HLRW from commercial nuclear power plants.

The members of the NWSC are supportive of S. 2589, the Nuclear Fuel Management and Disposal Act of 2006, introduced by Chairman Domenici at the request of the Administration. We note that S. 2539 would provide funds Through the end of the fiscal year during which construction is completed for the Nevada rail line and surface facilities for the fully operational permanent repository. In addition, fees collected by the DOE and deposited in the NWF, shall be credited to the NWF as discretionary offsetting collections each year in amounts not to exceed the amounts appropriated From the NWF for that year. Most importantly, Congressional oversight of the Program funding will continue, similar to the annual appropriations process of the Nuclear Regulatory Commission and the Corps of Engineers.

As several members of Congress commented, "This Program has been starved for funding" . . . the 2010 deadline for waste fuel acceptance at Yucca Mountain was, "a pipe dream at existing funding levels." The only way that the DOE will ever achieve its objectives is for Congress to reclassify the NWF receipts as offsetting collections. Only a long-term funding fix will enable the DOE to stay on schedule; submit a high-quality licensing application; foster exemplary standards of quality assurance, accountability and integrity in the Program's activities; and implement a transportation infrastructure systems plan that meets the deadlines it sets.

NUCLEAR WASTE FUND

There are adequate funds available to implement the Federal policy for permanent disposal of SNF and HLRW. That statement is conditioned on the premise that Congress will vote to support its own legislation—Congress has failed to support the NWP. Since 1983, ratepayers from 41 states have paid more than \$27 billion, including interest, into the NWF to fund the DOE's establishment of a safe, timely, and cost-effective centralized storage and permanent disposal of SNF and HLRW. The nation's ratepayers pay more than \$750 million per year into the NWF, and with interest credits, this amount exceeds \$1 billion annually. After deducting expenses to date, the fund now holds approximately \$18 billion, including interest.

This account balance has been used to support other programs and camouflage the Federal deficit rather than the development of the permanent repository. Consequently, more than 50,000 metric tons of SNF and HLRW are presently stranded at more than 100 sites (commercial and defense) in 39 states. Congress's support to codify the NWF annual receipts will ensure that every cent collected from the ratepayers will be delivered to the Program, as intended by the NWPA.

LAWSUITS

It is more than eight years since the DOE defaulted on its obligations, as stated in the Nuclear Waste Policy Act of 1982, to remove SNF from the nation's nuclear power plants. In its 1996 Indiana-Michigan decision, the U.S. Court of Appeals affirmed that the DOE was obligated to start moving waste on January 31, 1998, "without qualifications or condition." The DOE ignored the Court, prompting 46 state agencies and 36 utilities to again seek relief through the Courts. The DOE has meanwhile ignored repeated Court orders to begin moving waste from commercial nuclear plant sites on the grounds that it has yet to build a permanent repository and has no authority to provide an interim storage and transport of high-level nuclear material from plant sites. Several lawsuits are currently being heard in the U.S. Court of Claims and could find the DOE liable for several billions of dollars in damages due to its failure to meet its 1998 obligations. Further, the 11th Circuit Court of the U.S. Court of Appeals has already ruled that these damage payments will not come from the Nuclear Waste Fund. Consequently, Congress will have to choose where the funds should come from and which programs will be affected. If the DOE fails to meet the deadlines it sets, the financial liability the DOE faces through lawsuits will continue to mount. As the DOE continues to delay honoring its contracts with the utilities to remove spent nuclear fuel from plant sites, both the amount of SNF and HLRW stored and the costs associated with storing it increase. A DOE contractor has estimated that each year's delay will escalate Program costs by approximately \$1 billion per year for the civilian and defense nuclear waste disposal programs. The longer Congress refuses to fully fund the DOE requirements, the greater the potential liability will be to the nation's taxpayers.

TRANSPORTATION—RIGOROUS SAFETY STANDARDS

The DOE has proven that it can safely transport SNF and HLRW from plant sites across the nation. Since the 1960s, more than 3,000 shipments of spent nuclear fuel from nuclear power plants, government research facilities, universities and industrial facilities traveling over 1.6 million miles, "without a single death or injury due to the radioactive nature of the cargo."¹ This equates to more than 70,000 metric tons of SNF, an amount equal to what the NWPA authorizes for Yucca Mountain. Shipments include 719 containers from the Naval Nuclear Propulsion program between 1957 and 1999, and 2,426 highway shipments and 301 railway shipments from the U.S. nuclear industry from 1964 to 1997. In addition, since 1996, shipments of spent nuclear fuel have been safely transported to the United States from 41 countries to the DOE facilities;² again, without a single death or injury—not one. If a repository is licensed at Yucca Mountain, the DOE projects approximately 4,300 shipments over a 24-year period, averaging 175 shipments of spent nuclear fuel per year, a relatively small amount compared with the approximately 300 million annual shipments of hazardous materials (explosives, chemicals, flammable liquids, corrosive materials, and other types of radioactive materials) that are currently transported around the country every day.

Furthermore, the DOE has safely and successfully made more than 4,581 shipments to the Waste Isolation Pilot Plant (WIPP) in New Mexico as of May 8, 2006.³ The Western Governors' Association (WGA) signed an agreement with the DOE in April 1996 that affirmed regional planning processes for safe transportation of radioactive material. All regional high-level radioactive waste transportation committees also endorsed the WGA approach. The WTPP transportation planning system is setting the standard for safety and proving to be a critical step toward solving the nations spent nuclear waste disposal transportation program.

To ensure safety at on-site spent fuel storage facilities and during transportation, the material is stored in containers that meet the NRC's rigorous engineering and safety standards testing. To satisfy the NRC's rigorous standards for subsequent transportation approval, these containers have been dropped 30-feet onto an unyielding surface, dropped 40 inches onto a 6-inch vertical steel rod, exposed for

¹ National Conference of State Legislatures' Report, January 2000.

² U.S. Department of Energy Report to the Committees on Appropriations, January 2001.

³ Waste Isolation Pilot Plant Information Center, May 8, 2006.

30 minutes to a 1,475°F fire, submerged under 3 feet of water for eight hours, immersed in 50 feet of water for at least eight hours (performed in a separate cask), and immersed in 656 feet of water for at least one hour.⁴

CONCLUSION

For the last 20 years or so, those who want to derail commercial nuclear power in this country have used this program as a political tool. In fact, the Federal government's failure to deliver extends back several decades. The U.S. Congress must immediately address the growing problem of SNF and HLRW that now exists. We can no longer pretend that stranded waste at plant sites does not exist and is without economic consequence to the nation's energy supply as witnessed in August 2003 and presently. We can no longer pretend that the problem of stranded SNF and HLRW is going away. It is vitally important that the leadership in Congress fast track legislation for the continued progress of the permanent repository. While the Program continues to face complex challenges, passage of legislation will allow the Program to remain viable and ultimately succeed. Legislation has already been introduced by the opposition for the DOE to take title of SNF at plant sites. Their bill proposes stranding fuel indefinitely throughout the nation while the nation's ratepayers continue to pay in perpetuity into the NWF. It is vitally important that members of Congress place this nation interest first. Taking title of and stranding SNF and HLRW indefinitely throughout the nation is not an acceptable option, and it does not diminish in any way the need for, or the urgency of, a geologic permanent repository at Yucca Mountain. Under Section 160 (b) of the NWPA, the Secretary will report to the President and Congress on or after January 1, 2007, but not later than January 1, 2010, on the need for a second repository. The DOE has already stated that they would start with the two-dozen candidate sites that they looked at the first time.

Those members of Congress that oppose reform of the NWPA are supporting a short-term political issue. They are urged to take a long-term view for the best interests of their own state and our country. The members of the NWSC reiterate the importance for Congress to keep the DOE on target and schedule by reclassifying the NWF annual receipts as offsetting collections to bring the nuclear waste disposal program to fruition as promised and mandated by the Nuclear Waste Policy Act of 1982, amended.

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⁴Nuclear Regulatory Commission Testing Requirements, 10 CFR Sections, 71.61, 71.71, and 71.73.